

# **BMO Capital Markets**

## **Commodity Risk Measurement, Valuation & Control Infrastructure Assessment**



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# Executive Summary

BMO Capital Markets (“BMO”) has retained Deloitte & Touche LLP (“Deloitte & Touche”) Global Energy Markets practice to conduct an independent assessment of its commodity valuation, risk measurement, reserving methodology and control infrastructure associated with the Bank’s energy transacting activities. The purpose of this document is to:

- Assess BMO’s existing risk control infrastructure from both a design and operating effectiveness perspective;
- Assess BMO’s specific commodity valuation, risk measurement and reserving methodologies;
- Document and present current prevalent energy industry practices;
- Identify and assess the strengths, weaknesses and/or gaps in existing risk infrastructure and selected methodologies;
- Identify deficiencies and recommend opportunities for improvement; and
- Prioritize recommendations for implementation consideration.

BMO’s Commodity Trading group is focused on utilizing the strength of its balance sheet, built upon its **existing** energy client relationships and providing a comprehensive product offering enabling maximum revenue generation while operating at management approved risk levels. The business transacts in financial natural gas, crude oil and petroleum products. These transacting activities are executed, measured and monitored in two primary portfolios:

Natural Gas Portfolio, which is comprised of four books.

- **NG Options**, which consists of NYMEX and Pipeline Options, Swaptions and Swaps.
- **AECO**, which consists of NYMEX and AECO Pipeline Options and Swaps.
- **Basis**, which consists of Pipeline Basis Swaps.
- **Linear**, which consists of NYMEX Swaps.

Crude Oil & Petroleum Products Portfolio, which is comprised of one book.

- **Crude**, which consists of WTI and Petroleum Products Options, Swaps and Swaptions instruments.

Several aspects of BMO’s commodity portfolios are unique and characteristically different than most peer group commodity portfolios in size and complexity. Specific unique traits include:

- The composition of the commodity portfolio is heavily weighted toward financial natural gas options;
- The natural gas option portfolio has a relatively significant portion of out-of-the money options;
- The deep out-of-the-money strikes and tenors of the current natural gas portfolio are relatively illiquid; and
- A majority of the transacting activity is customer focused within three predominant customers classes: Producers, Hedge Fund (Professionals) and Market Liquidity Provider (i.e., Financial Institutions). Other trading and marketing counterparts include: Processors, Refiners, Industrials, Utilities, Marketers, Diversified, Municipalities, and Individuals.

Typically, within the peer group commodity portfolios are more evenly balanced across commodity asset classes and instruments. In general, commodity portfolios are able to benefit from commodity diversification. The risk and return between participants in the commodity markets differs between organizations. While the specific characteristics of BMO’s commodity portfolio must be taken into account in assessing the potential risks it may be exposed to, it is clear that BMO’s portfolio is subject to higher liquidity risk as seen in some exotic structured products or illiquid energy market locations.

The following section provides a summary of observations (findings) and recommendations, which are detailed in the Design and Operating Effectiveness section of this report. In many instances the gaps identified are symptoms of a higher level “common cause”. Rather than dealing with the individual symptoms, a more strategic approach can be adopted that focuses on these common causes.

Our assessment is separated into two primary categories: Design Effectiveness and Operating Effectiveness. Design Effectiveness focuses on identifying key components in the risk control infrastructure and assessing whether their stated objectives are being met. Operating Effectiveness focuses on identifying whether the risk control infrastructure components are an effective enabler for management to measure, monitor and manage the risks and returns associated with its commodity transacting activities.

We believe this information can be summarized into several broader observations and recommendations within the design and effectiveness framework, namely:

### SUMMARY OF OBSERVATIONS

	Objective	Observation (Common Cause)
<b>Design Effectiveness</b>	The design of a risk control component is considered to be effective if the risk control activity is designed to meet its risk control objective.	<b>Transactional Controls</b> <b><i>Integrity of Market Data Collection</i></b> <ul style="list-style-type: none"> <li>Market Risk determines price sources in conjunction with Front Office as documented by the ORSD. The majority of prices are independently provided to the back office based on the ORSD. Recently, for specific quotes relating to options BMO has begun to collect both consensus market data and third party broker quotes to independently verify and calculate the natural gas portfolio's valuation and corresponding reserves. Since February 2007 month end, it was agreed that Market Risk will provide the traders requests for quotes and the traders will provide Market Risk the relevant IM's in Market Risk's presence. The trader will request live tradable pricing from multiple brokers.</li> <li>Market Risk view differs on one point and that is it is required to contact the Front Office before requesting quotes from brokers for the specific pricing relating to options mentioned directly above.</li> </ul>
		<b>Market Risk Management</b> <b><i>Independent Market Data Sources</i></b> <ul style="list-style-type: none"> <li>The Operating Standard for the selection of independent market data sources references only one broker, Optionable, for Gulf Coast, Mid Continent and West Coast options and swaptions.</li> </ul>
		<b>Market Risk Management</b> <b><i>Model Testing Approach</i></b> <ul style="list-style-type: none"> <li>BMO's VaR testing methodology entails testing changes related to risk bucketing, seasonality and rollover window for six non-consecutive days.</li> </ul>
		<b>Market Risk Management</b> <b><i>Skew Calibration Process</i></b> <ul style="list-style-type: none"> <li>The current BMO skew calibration process is relatively informal and not documented.</li> </ul>
<b>Operating Effectiveness</b>	The operating effectiveness assesses the extent (i.e., effectiveness) to which the risk control component is enabling BMO's	<b>Risk Management Governance</b> <b><i>Book Structure</i></b> <ul style="list-style-type: none"> <li>The Front Office reverses all transactions at day end from the "Crude New" portfolio into the respective Petroleum Products, Crude OTC, Crude Exchange Traded, Products and Foreign Exchange books.</li> </ul>

	Objective	Observation (Common Cause)
	enabling BMO's management to measure and monitor the Bank's transacting activity in terms of stated and approved risk management policies, practices and procedures.	<p><b>Market Risk Measurement</b></p> <p><b>Market Data Sourcing - Illiquid</b></p> <ul style="list-style-type: none"> <li>Market Risk determines price sources in conjunction with Front Office as documented by the ORSD. The majority of prices are independently provided to the back office based on the ORSD. Recently, for specific quotes relating to options BMO has begun to collect both consensus market data and third party broker quotes to independently verify and calculate the natural gas portfolio's valuation and corresponding reserves. Since February 2007 month end, it was agreed that Market Risk will provide the traders requests for quotes and the traders will provide Market Risk the relevant IM's in Market Risk's presence. The trader will request live tradable pricing from multiple brokers.</li> <li>Market Risk view differs on one point and that is it is required to contact the Front Office before requesting quotes from brokers for the specific pricing relating to options mentioned directly above.</li> </ul> <p><b>Market Data Collection and Integrity</b></p> <ul style="list-style-type: none"> <li>Additionally, the Market Risk is required to utilize the Front Office to collect third party quotes (i.e. instant messaging and broker quote sheets) for independent verification at month end. "By required to utilize" the middle office can not contact brokers without discussing with the Front Office. The Front Office characterizes this approach as working in concert with the Market Risk to obtain prices.</li> </ul> <p><b>Value-at-Risk Measures</b></p> <ul style="list-style-type: none"> <li>BMO Market Risk does not account for seasonality and does not provide enough granularity in it's bucketing approach in the current VaR methodology.</li> </ul> <p><b>Close-out/Liquidity Reserves</b></p> <ul style="list-style-type: none"> <li>Valuation Product Control calculates a close-out adjustment by applying a mid / bid factor to the open delta and vega NYMEX (or OTC with same underlying) positions aggregated by maturity period (bucketed by seasonal and calendar strips). The mid / bid factor was determined several years ago based on the historic mid / bid spread, and has not since been updated.</li> <li>Additional reserves are recorded for fixed price exposure and pipeline (basis) exposure. Calculation of the close-out adjustment for fixed price and pipeline risk is calculated in a manner consistent with the close-out adjustment described above. Specific reserve adjustments may also be taken to account for other market data uncertainties.</li> <li>Open delta and vega positions used in the close-out reserve calculations described above are "lagged". Lag factors are maintained by the Front Office and reviewed periodically by Market Risk. Risk Reporting extracts the lagged position report from the PRA system and forwards to VPC for the close-out reserve calculation.</li> </ul>

**SUMMARY OF RECOMMENDATIONS FOR BMO'S CONSIDERATION**

A more comprehensive listing of suggested recommendations is located in Appendix 3.

	Short Term	Observation (Common Cause)
<b>Design Effectiveness</b>	Considered for implementation within the next month	<b>Transactional Controls</b> <b><i>Integrity of Market Data Collection</i></b> <ul style="list-style-type: none"> <li>BMO should include context in the IPV and Official Rate Source Document stipulating Market Risk's independence with respect to the collection of market data. For the specific quotes not gathered by the back office, Market Risk should independently contact select brokers to collect broker quotes or work in conjunction with the front office and watch/audit the collection of market data. This ensures integrity of the market data gathered. Market risk has the final decision as to determination of value for a pricing point and always obtains the right to contact brokers independently of the front office. This type of process was put in place during the Deloitte engagement at the end of February 2007.</li> </ul>
		<b>Market Risk Management</b> <b><i>Independent Market Data Sources</i></b> <ul style="list-style-type: none"> <li>BMO should consider updating its Operating Standards and Procedures document to specify the selection of independent market data sources and the hierarchal approach to using this data. The procedure should reference at least two additional independent pricing sources for each instrument and pricing location.</li> </ul>
		<b>Market Risk Management</b> <b><i>Model Testing Approach</i></b> <ul style="list-style-type: none"> <li>BMO should consider lengthening its testing phase after making adjustments to the NVaR system. The six days non-consecutive approach is acceptable but does not meet prevailing industry practices for risk model testing. Prevailing testing practice constitutes 30 consecutive business days over 2 roll periods (standard minimum practice). This allows for a broader perspective to capture more types of transactions or changes in portfolio composition.</li> </ul>
		<b>Market Risk Management</b> <b><i>Skew Calibration Process</i></b> <ul style="list-style-type: none"> <li>BMO should consider creating documentation to formalize this process and vet for reasonableness. Prevailing practice is for the middle office to vet month end skew calibrations as executed by the front office based upon a documented methodology.</li> </ul>
<b>Operating Effectiveness</b>		<b><i>Risk Management Governance – Book Structure</i></b> <ul style="list-style-type: none"> <li>BMO should consider streamlining this process to more efficiently and effectively designate and capture Crude Oil related transactions directly into their corresponding portfolio at the time of execution.</li> </ul>

	Short Term	Observation (Common Cause)
		<p><b>Market Risk Measurement – Market Data Sourcing Illiquid</b></p> <ul style="list-style-type: none"> <li>▪ BMO Front Office/Market Risk and Back Office should consider using multiple market data sources to enhance price transparency and reliability. The use of multiple brokers beyond one primary broker source ensures consistency within the market data collection and valuation process and provides integrity to the liquidity reserving process.</li> <li>▪ BMO Market Risk should update Official Rate Source (ORS) documentation to include the identification of specific sources of independent data, a hierarchy or reliability of each source, and the method used to aggregate the sources that will be used. At this time only one broker (Optionable) is listed for Gulf Coast, Mid Continent, and West Coast options and swaptions. The document should reference additional independent pricing sources for each instrument and pricing location.</li> <li>▪ BMO Market Risk should use multiple data sources, including independent broker quotes and consensus data for independent mark validation process. These market data sources often provide quotes, or pricing consensus, across various strikes and tenors; however, most do not provide a comprehensive grid of option products (pricing for all strikes and tenors). BMO should model the pricing information provided to derive independent price data for the missing points.</li> <li>▪ BMO Market Risk should compare the weighted average of the independent source data to the internal marks with weights determined by reliability and relevance.</li> <li>▪ BMO Market Risk should use a 1 volatility threshold where differences in excess of the threshold are aggregated and recorded as an Independent Price Verification (IPV) reserve (See Liquidity Reserves). Please note that while other institutions utilize a 1 volatility threshold these institutions in our understanding did not have such a large dollar value difference between the 1 volatility thresholds and a zero volatility threshold. BMO may want to look into developing an absolute dollar cap allowed under a one volatility tolerance. This cap should consider BMO's level of risk tolerance.</li> </ul> <p><b>Market Risk Measurement – Value-at-Risk Measures</b></p> <p>BMO Market Risk should complete the proposed changes to the VaR methodology to capture seasonality and provide granularity in bucketing to be consistent with prevailing practices in the industry.</p>
		<p><b>Market Risk Measurement – Liquidity Reserves</b></p> <p>BMO Market Risk should consider reviewing the current close-out charges to ensure the adjustment reflects the market observed mid/bid spread. Additionally, BMO should consider using “unlagged” delta and vega positions in the close-out reserve calculation. Also, the bid/ask spread is expected to increase as liquidity decreases resulting in a more significant reserve on positions.</p>

	Long Term	Observation (Common Cause)
<b>Design Effectiveness</b>	Considered for implementation within the current year	<p><b>Risk Management Governance</b></p> <ul style="list-style-type: none"> <li>BMO should consider reviewing and updating its Risk Management Policy, Market Risk Management Standard and procedure documentation to clarify newly adopted risk management methodologies and supporting business processes.</li> </ul> <p><b>Transactional Controls</b></p> <ul style="list-style-type: none"> <li>BMO should consider reviewing and updating its operational control documentation to expand on: off premise trading guidelines, automation of price aggregation and formal listing of certain risk management reports.</li> </ul> <p><b>Market Risk Measurement</b></p> <ul style="list-style-type: none"> <li>BMO should consider updating its Market Risk Operating Standard documentation to include references to systems containing data related to market risk processes.</li> <li>BMO should consider updating its Market Risk Management Standard document to clearly define market risk tolerance limits.</li> <li>BMO should consider elaborating on the Market Risk Corporate Policy and Market Risk Management Standard regarding the types of risk taken by the commodities desk.</li> </ul> <p><b>Credit Risk Management</b></p> <ul style="list-style-type: none"> <li>BMO should consider developing a single credit reference document summarizing commodity credit practices.</li> <li>BMO should consider expanding its processes by which transacting personnel are required to review and provide written acknowledgement of changes to credit risk management guidance.</li> <li>BMO should consider strengthening the language contained in the Ethical Standards and Compliance Guidelines related to compliance with credit practices.</li> </ul>
<b>Operating Effectiveness</b>		<p><b>Risk Management Governance</b></p> <ul style="list-style-type: none"> <li>BMO should consider addressing roles and responsibilities during a formal exchange to resolve an existing disconnect between Market Risk duties in Toronto and New York and the Front Office.</li> <li>BMO should consider delineating the marketing and proprietary trading activities in the existing natural gas option trading portfolio.</li> <li>BMO should consider clarifying and integrating its standard and ad hoc risk reports according to role and purpose.</li> </ul> <p><b>Transactional Controls</b></p> <ul style="list-style-type: none"> <li>BMO should consider implementing risk weightings by customer segment and related transacting activity to ensure better alignment of market risk exposure of the portfolio with the risk profile of the commodity business.</li> <li>BMO should consider including off premise transacting privileges in current limit delegations.</li> <li>BMO should consider investigating other approaches to providing real time counterparty credit checks to support its commodity transacting business.</li> </ul>



	Long Term	Observation (Common Cause)
		<p><b>Market Risk Measurement</b></p> <ul style="list-style-type: none"> <li>▪ BMO should consider formally automating the price aggregation process for uploading official data sources which may reduce potential administrative risks associated with manual forward curve manipulation and construction.</li> <li>▪ BMO should consider at least two external sources of data to validate the front office markets.</li> <li>▪ BMO should consider migrating its current volatility surface calculation from a quadratic formula based approach to a more sophisticated stochastic volatility approach.</li> <li>▪ BMO should consider establishing formal protocols for skew recalibration for both the front office and middle office verification.</li> <li>▪ BMO should consider reviewing and updating its close-out and liquidity factors on a quarterly basis to ensure market conditions and observed mid/ bid spreads are reflected in the adjustment.</li> </ul>

# Project Overview

## BACKGROUND

BMO is in the process of evaluating its commodities transacting infrastructure and requested assistance to assess various front, middle and back office business processes and controls. Specifically, BMO requested an independent third party to assess its current energy commodity risk measurement and valuation capabilities, reserve methodologies and control infrastructure to determine whether they are consistent with prevalent energy industry practices in use by peer firms engaged in similar capital market's energy transacting and risk management activities. Primary focus covered the varying aspects of the transaction lifecycle with specific emphasis on the natural gas and crude oil pricing in regards to valuation, risk measurement and reserving methodologies currently used by the Bank. To that end, BMO retained Deloitte & Touche to conduct an independent benchmarking assessment of its current infrastructure to prevailing practices.

## SCOPE AND OBJECTIVES

The scope of this engagement is limited to the assessment of BMO's valuation, commodity risk measurement, reserving methodology and control infrastructure of the Bank's energy transacting activities. In our experience, such assessments of an entity's energy risk infrastructure are most effectively executed in the three phased approach described in the "approach" section of this report.

The purpose of this assessment was to accomplish the following objectives:

- Assess BMO's existing risk control infrastructure from both a design and operating effectiveness perspective;
- Assess BMO's specific commodity valuation, risk measurement and reserving methodologies;
- Document and present current prevalent energy industry practices;
- Identify and assess the strengths, weaknesses and/or gaps in existing risk infrastructure and selected methodologies;
- Identify deficiencies and recommend opportunities for improvement; and
- Prioritize recommendations for implementation consideration.

*It is important to note that this assessment was performed in accordance with Standards for Consulting Services established by the American Institute of Certified Public Accountants. Deloitte & Touche will not provide any assurances regarding the sufficiency of the services provided for BMO's purpose. Deloitte & Touche services provided in conjunction with this assignment will not constitute an engagement to provide audit or attestation services as described in the pronouncements on professional standards issued by the American Institute of Certified Public Accountants and, accordingly, Deloitte & Touche will not provide any assurance concerning the reliability of any assertion that is the responsibility of another party. These services will not result in the issuance of any written or oral communication by Deloitte & Touche expressing a conclusion or any form of assurance with respect to financial data or internal controls to the Company or any third party. Deloitte & Touche will not perform any management functions, make management decisions, or perform in a capacity equivalent to that of an employee of BMO. The procedures to be performed will not constitute an audit, a review or a compilation of BMO's financial statements or any part thereof, nor an examination of management's assertions concerning the effectiveness of BMO's internal control systems, or an examination of compliance with laws, regulations, or other matters. Accordingly, our performance of the procedures will not result in the expression of an opinion, or any other form of assurance, on BMO's financial statements or any part thereof, nor an opinion, or any other form of assurance, on BMO's internal control systems or its compliance with laws, regulations, or other matters.*

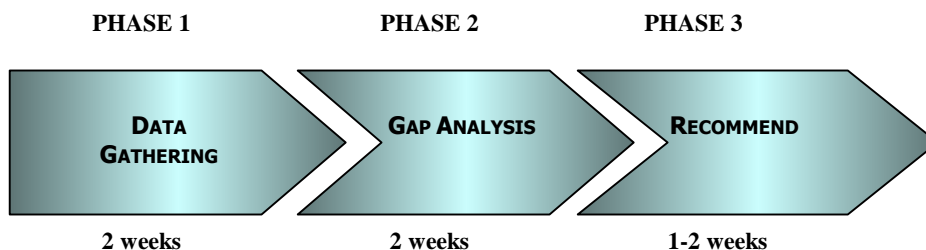
*Given these limitations, our work specifically did not include the following:*

- *Performing detailed tests of compliance of historical transaction testing to determine that controls are operating in accordance with their design;*
- *Performing an independent valuation of transactions or validating quantitative methods, calculations or models;*
- *The development of any quantitative models;*
- *Evaluating the appropriateness of transacting and risk mitigation strategies; and*
- *Implementation of suggested risk measurement, valuation, reserve or control infrastructure recommendations.*

## APPROACH

Deloitte & Touche assessed BMO's commodity risk measurement, valuation, reserve and risk controls and associated transactions utilizing a three-phased approach, which is graphically depicted in Figure 1: Project Phases below.

**Figure 1: Project Phases**



A brief description of the work performed in each phase is provided below.

### Phase 1 – Data Gathering

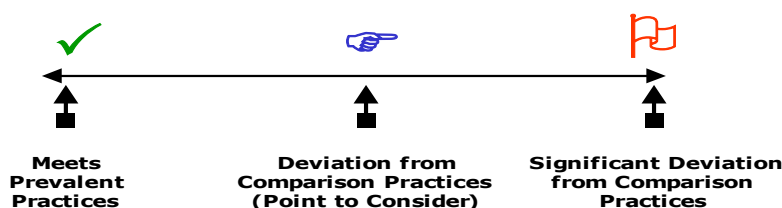
Phase 1 represents an extensive “fact-observation” exercise to develop a comprehensive understanding of BMO's transacting and risk management activities. Deloitte & Touche gathered information through interviews with BMO's commodity product line and corporate risk measurement personnel. The information obtained from our interviews provided a foundation for our report. A comprehensive list of individuals interviewed is provided in Appendix 1: Interview Schedule.

In addition, Deloitte & Touche examined relevant commodity risk measurement, valuation, reserve and infrastructure controls documentation (e.g., policies, procedures, organizational charts, process flows, reports, etc.) that served to support topics discussed during the interview sessions. Deloitte & Touche's overall evaluation considered these documents, where applicable, and specific key documents are referenced throughout this report to provide meaningful context between observations and recommendations. A comprehensive list of documents Deloitte & Touche assessed is provided in *Appendix 2: Documentation Sources*.




### Phase 2 – Gap Analysis (Assessment)

Phase 2 represents the benchmarking exercise where Deloitte & Touche's observations of BMO's current practices are compared against industry prevalent practices. Additionally, detailed business process and methodology reviews are performed to assess the design and operating effectiveness of the risk control infrastructure. In performing our risk control infrastructure assessment, we utilized a rating scale shown in Figure 2: Assessment Rating Scale. Each aspect of assessment is evaluated using this scale, and is supported with commentary regarding BMO's current practices to provide context and rationale for the ratings. Prevalent Industry Practices, by definition, are attainable and should be viewed within the context of cost versus benefits provided as well as alignment with management's risk philosophy and appetite. Each rating can be further defined as follows:

Figure 2: Assessment Rating Scale



## Assessment Legend

Rating Symbol	Rating	Description
	<b><i>Meets Prevalent Practices</i></b>	Existing practices are in line with energy industry prevalent practices in terms of design and use.
	<b><i>Deviation from Prevalent Industry Practices (Point to Consider)</i></b>	Intended to highlight practices that could be improved. Although irregularities and errors may occur for <i>Points to Consider</i> , as compared to <i>Significant Deviation from Comparison Practices</i> , we would consider these points to be less severe, and corrective actions being considered in either short or longer-term business planning.
	<b><i>Significant Deviation from Prevalent Industry Practices</i></b>	Intended to alert management to risk control practices that are considered control weaknesses. <i>Standard Deviation from Comparison Practices</i> warrant immediate attention and correction and, if not corrected, could lead to significant irregularities and/or errors. These should be corrected prior to reliance on any part of the transaction processing or risk management infrastructure.

The application of Prevalent Practices is also subject to other limitations.

- Prevalent Practices offer insights into market participant's capabilities, and a directional compass for subsequent infrastructure development. Prevalent Practices continue to evolve. Furthermore, the development and implementation of such practices does not assure that certain risk control objectives will be achieved.
- Many Prevalent Practices reflect the capabilities of financial institutions that primarily transact and manage risk in the more traditional financial markets. Our representation of Prevalent Practice, in this circumstance, reflects an interpretation that we believe provides meaningful benchmarks relevant to developing prospective capabilities in the energy markets.

The sources for Prevalent Practices are diverse. In performing our work, Deloitte & Touche utilized the following sources for Prevalent Practices to benchmark BMO's related business practices:

- Deloitte & Touche experience with its established energy and financial services clients who manage risk as a core competency;
- Committee of Sponsoring Organizations of the Treadway Commission (COSO) – "Internal Control Issues in Derivatives Usage" (1996);
- Basel Committee Capital Accord (1988);
- Derivative Practices and Principles, Global Derivatives Study Group, Group of Thirty (1993);
- U.S. Office of the Comptroller of the Currency (OCC) Banking Circular and Comptroller's Handbook (1994);
- Board of Federal Governors Trading and Capital Markets Activities Manual (also known as "Federal Examiner's Handbook") (2000); and
- Committee of Chief Risk Officers (CCRO) "Governance, Valuation, Credit, Disclosure Whitepapers" (2002).

### **Phase 3 – Develop Recommendations**

Phase 3 represents the documentation of observations and identification of meaningful opportunities for improvement. Careful analysis is performed to identify the differences between high and low impact issues. High impact issues are aggregated and prioritized before high-level recommendations are proposed. Working with management we will categorize and prioritize areas of importance or criticality relative to the Bank's current business needs. Where possible, we will provide commentary on potential impacts to the Bank's known future business strategies.

## Report Structure

This report is divided into four main sections:

- 1) *Executive Summary*
- 2) *Project Overview*
- 3) *Assessment and Recommendation*
- 4) *Appendix*

### ***Executive Summary***

The Executive Summary is intended to provide BMO Capital Markets executive management a high level understanding of our primary findings and recommendations.

### ***Project Overview***

The Project Overview presents a synopsis of the risk assessment engagement. The Project Overview is divided into the following sections:

- Background
- Scope and Objectives
- Approach
- Report Structure

### ***Assessment and Recommendation***

The Assessment and Recommendation section presents the detailed observations and corresponding suggestions for improvement for each category at the risk component level. Deloitte & Touche utilized a proprietary risk control database as guidance to compare BMO's existing practices against industry prevalent practices. This section is the culmination of the matrix results and provides recommendations addressing specific risk control infrastructure weaknesses.

In order to present observations and recommendations in a clear and concise manner, the three categorizes of the risk control infrastructure framework: Risk Governance, Transactional Control, and Market Risk Measurement and Management, and Credit Risk Management are presented using the following format:

- Prevalent Industry Practice
- Current Practice
- Assessment Rating
- Recommendations

### ***Appendix***

The Appendix contains selected reference items that were used to develop observations and recommendations in the main report sections described above.

# Assessment and Recommendation

## RISK MANAGEMENT CONTROLS DESIGN EFFECTIVENESS

The following section is a high-level overview assessment of select BMO's risk control infrastructure utilizing a hierarchical risk framework. Specifically, we analyzed four primary "building block" categories related to BMO's energy commodity transacting activities. Each of these categories has a formal structure that provides guidance to the Bank's functional operations. These protocols and guidelines are typically embodied in an organization's approved Risk Management Policies and Procedures. Policies and procedures provide consistency and transparency in daily operational functions. Deloitte & Touche assessed the design element of BMO's risk control policies and procedures to prevailing industry practice.

The reviewed risk control infrastructure design components are shown in Table 1 below.



**Table 1**

A. Risk Management Governance	B. Transactional Controls	C. Market Risk	D. Credit Risk
<ul style="list-style-type: none"> <li>Risk Management Policy</li> </ul>	<ul style="list-style-type: none"> <li>Risk Procedures</li> </ul>	<ul style="list-style-type: none"> <li>Market Risk Management Policy and Standards</li> </ul>	<ul style="list-style-type: none"> <li>Credit Risk Management</li> </ul>

### A. Risk Management Governance

This segment of our design assessment compared BMO's current energy commodity risk management policies to industry prevalent policy components. Where applicable, we identified areas where BMO's energy commodity policies met, could be improved or were significantly different than industry norms.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<b>1. Component: Risk Management Committee ("RMC")</b>			
A1 - A Risk Management Policy (RMP) should establish guidelines for monitoring and controlling the financial risks related to the energy commodity product line trading activities.	The Risk Management Committee has an enterprise-wide mandate set forth in the RMC Mandate Final 29Oct03 documents, which includes BMO Financial Group, all of its subsidiaries and affiliates and is applicable to all categories of risk.	✓	Operating policies and procedures related to monitoring financial risk are consistent with Prevailing Industry Practices.
A2 - A RMP is designed to ensure that the risks incurred are consistent with senior management's expectations.	The RMC ensures that all risk taking activities are within the risk appetites and limits granted to the CEO from the Board of Directors, and within the approved strategies and operating policies and procedures.	✓	Operating policies and procedures related to risk appetite are consistent with Prevailing Industry Practices.
A3 - A RMP includes a definition of the Bank's risk tolerance, transacting objectives, and major sources of risk.	The RMC Mandate addresses and defines the risk profiles related to the Bank's strategy as it pertains to the following: <ul style="list-style-type: none"> <li>Credit and counterparty risk issues</li> <li>Market risk</li> <li>Operational risk</li> <li>Integrated risk</li> <li>Management of liquidity and funding risk</li> <li>Management of business risk</li> <li>Material regulatory requirements</li> <li>Industry practices and current state</li> </ul>	✓	Operating policies and procedures related to risk tolerance, transacting objectives, and major sources of risk are consistent with Prevailing Industry Practices.
A4 - A RMP includes a description of the roles and responsibilities and delegated authorities within the organization.	Section 3, Committee Responsibilities, of the RMC Mandate describes the roles and responsibilities of the RMC and sub-committees therein.	✓	Operating policies and procedures related to roles and responsibilities and delegated authorities within the organization are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
A5 - A RMP includes the scope of authorized activities.	The scope of transacting activities is loosely defined in the contents of the Risk Management, Market Risk, and Traded Credit Risk Policies. However, detailed transacting scopes defining attributes such as specific instruments by book are not clearly illustrated in the aforementioned guidelines.		The Bank should consider clarifying Market Risk Management Standard documentation around the scope of transaction mandates for each commodity/book.  There is no delineation between marketing and proprietary trading mandates recognized in the book structure. BMO should consider the creation of separate trading books in order to discern between these trading activities.  Also, the scope does not address the transfer of risks through inter-book activities, and how these risks should be monitored and tracked. BMO should consider including documentation around inter-book trades to its standards.
A6 - A RMP includes New Product Approval Process and Non-Standard Transaction Process	Market Risk Corporate Standard (October 2006) establishes operating policies and procedures for the IBG New Products Approval Process and Immediate Approval Process. Approval must be obtained from the relevant Co-President, BMO Capital Markets or his/her delegate and from Market Risk Oversight through the Immediate Approval Process, prior to execution and additional approval is obtained from other key stakeholders in the New Products Approval Process.	✓	Operating policies and procedures related to new product approval process and non-standard transaction process are consistent with Prevailing Industry Practices.
A7 - A RMP includes a summary of market and credit risk limits	The Market Risk Corporate Standard and Traded Credit Risk Corporate Standard stipulate limits for transacting activities.  Market risk limits distinguish between primary and secondary; traded credit risk limits establish permitted holding periods and a variety of risk limits.	✓	Operating policies and procedures related to market and credit risk limits are consistent with Prevailing Industry Practices.
A8 - A RMP includes Market Risk Management and appropriate practices for managing market risks.	The Market Risk Management Standard addresses five key elements of the management of market risks in the Market Risk Management Framework section:  1. Organizational Independence of Market Risk Management from Oversight Functions  2. Market Risk Limits  3. Market Risk Committee (MRC) and Balance Sheet Management Committee Oversight  4. The Attestation Process  5. The Policy Framework	✓	Operating policies and procedures related to managing market risks are consistent with Prevailing Industry Practices.
A9 - A RMP includes Credit Risk Management and appropriate practices for managing counterparty credit risks.	The Traded Credit Risk Corporate Policy is part of the Market Risk Management Standard and addresses three key elements of the management of counterparty credit risks in the Management Framework/Process section:  1. Risk Control Elements  2. Treatment of Stale Positions  3. Oversight / Risk Management	✓	Operating policies and procedures related to managing credit risks are consistent with Prevailing Industry Practices.
A10 - A RMP includes a description of the types of internal and external reports generated and distributed the frequency and responsibilities for review and approval.	The Market Risk and Traded Credit Risk Corporate Standards elaborate on the creation, distribution, and frequency of all risk-related reporting metrics for internal use.  A description of the executive risk management reporting package defining relevant financial performance metrics of the Bank is provided in the Corporate Governance document.		External reports typically belong to the executive reporting package prepared at month end, while internal reports are generally distributed on a more frequent basis. However, as a result of the current issues surrounding pricing and valuation, several ad hoc reports have been created to support existing analyses.  It may be prudent for BMO to consider incorporating those reports into its standard reporting packages on a forward basis. In order to discern between the additional reports and




Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	Detailed descriptions of the reporting process can be found in the Traded Credit and Market Risk Corporate Standards in Section 5: Reporting and Monitoring.		the original reporting, reports should be categorized accordingly by the Bank.  BMO should consider adding context to the RMP regarding specific roles and purpose for all standard reports, as well as the portfolio attributes defined. For example, the RMP should mention practices used to report on positions, P&L, and other characteristics by book.
A11 - A RMP includes a description of the Department's code of conduct and standards of compliance with stated protocols and approved Risk Policies.	According to the Risk Management Committee Mandate, 'It is the responsibility of each member of the Committee to identify any matters of materiality to the EVP and Head, Corporate Risk Management for inclusion as agenda items requiring consideration by the Committee.'	✓	Consistent with prevailing practices as all BMO personnel sign off on the Code of Conduct, as tracked by the compliance department.
A12 - A RMP establishes standards for consistent application of valuation adjustment(s) across the organization's derivatives portfolio(s). The document discusses the assumptions made in each valuation adjustment methodology.	Several documents, including the Valuation Reserves and Adjustments for Mark-to-Market Trading Portfolios (June 2006) and Commodity Derivatives Closeout and Liquidity Reserves Calculation Methodology, address reserve calculations at a high level; however, policies are seemingly informal and lack specific detail regarding assumptions made in the reserve calculations. For example, the closeout reserve charge is intended to represent the bid-mid spread. Approved sources of information underlying close-out charge should be clearly documented.	👉	Existing relevant documents should be cited and included in the Market Risk Management Standards as necessary and approved.

## B. Transactional Controls



This segment of our design assessment compares the BMO's documented transactional control procedure components to prevailing industry procedural components. Where applicable, we identified areas where BMO's procedural component aligned with industry practices and places where there was room for improvement or a significant deviation from prevalent practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
B1 - Transaction Initiation	"Off Premises" Trading Guidelines stipulates that traders must be authorized by the RMC to conduct "off-premises" trading. In this event the trader must communicate all essential transaction details to operations areas, which must validate "off-premises" authorization, ensure all details are received and entered into the system of record by the following trading day, confirm the transaction with the trader, ensure that alternate phone numbers are provided, and maintain a log for audit trail purposes of "off-premise" transactions.  Front Office procedures are defined by traded product in the "Off Premise Procedures Feb 2007 FINAL" document.	👉	Operating policies and procedures related to Transaction Initiation are consistent with Prevailing Industry Practices.  Off Premises Trading Guidelines should be incorporated as part of the Limit Letter sign off process to eliminate redundancy.
B2 - New Counterparty Approval	The Loan Products Group reviews all existing and potential counterparties and recommends credit limits. IBG Credit reviews these recommendations and either concurs or rejects it	✓	Operating policies and procedures related to New Counterparty Approvals are consistent with Prevailing Industry Practices.
B3 - Contract Administration	The Commodities Derivatives Operations group maintains and periodically makes revisions and verifies static data including	✓	Operating policies and procedures related to Contract Administration are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<p>counterparty and broker information, instruments, standard settlement instructions, and calendar holidays.</p> <p>To date, the following agreements have been executed by CP:</p> <ul style="list-style-type: none"> <li>ISDA Master Agreements</li> <li>Gas Master Agreements</li> <li>Futures and Listed Options Agreements</li> <li>Give-up Agreements</li> <li>ICE Agreement</li> <li>Long Form Confirmations</li> </ul>		
B4 - New Product Approval	<p>The New Product Approval Process and Immediate Approval Process for the IBG clearly elaborates on the following aspects of new products:</p> <ul style="list-style-type: none"> <li>Definition</li> <li>Approval Process</li> <li>LOB Roles and Responsibilities</li> <li>Market Risk Oversight roles and Responsibilities</li> <li>Operational Risk and Other Stakeholders Roles and Responsibilities</li> <li>IDP Threshold</li> <li>Delegation of Authority</li> <li>EORM Responsibility</li> <li>Documentation Templates and Protocols</li> </ul>	✓	Operating policies and procedures related to New Product Approvals are consistent with Prevailing Industry Practices.
B5 - Real Time, Term and Financial Transaction Execution	<p>BMO's energy commodities desk currently transacts in only financially traded instruments, though certain physical instruments have been approved for transacting.</p> <p>The majority of positions in the energy portfolio will roll-off within two years. Tenor limits are defined by book/trader in the corresponding Authority Letters.</p>	✓	Operating policies and procedures related to transaction execution are consistent with Prevailing Industry Practices.
B6 - Tape Recording and Monitoring	<p>The BMO IT Voice department ensures the conversations of all transacting personnel are recorded and maintained. All tapes are stored for a total of 191 days and during that time remain available for auditing purposes and trade dispute resolutions. The Back Office periodically reviews phone recordings in accordance with local regulations and law.</p>	✓	Current practices are consistent with Prevailing Industry Practices.
B7 - Market Data Collection	<p>The Commodity Derivatives Group's Official Rate Source Document (ORSD) and Price Verification Policy govern the price verification process for the CDG. The ORSD details price types/data to be collected and verified, a table listing independent sources used in the IPV process, and variance thresholds to be used for price verification for each price datum.</p> <p>The document also explains the price verification process, and the roles and responsibilities of Trade Controls and Market Risk pursuant to that end.</p> <p>Specific BMO activities include the following:</p> <p>1) Metals prices are automated from Bloomberg to a spreadsheet that is uploaded into MxCom; 2) Energy Futures Prices are copied directly from Reuters and pasted into an excel spreadsheet that is uploaded into MxCom; 3) Other data is</p>	👉	<p>The current end of month process calls for Front Office personnel to manually update pricing spreadsheets for several books.</p> <p>BMO should consider formally automating the price aggregation process for uploading official data sources. Vendors that provide tools to aggregate data are LIM, KiodeX, etc. Automating the price aggregation reduces potential administrative risks associated with manual forward curve manipulation and construction. BMO will still be required to independently verify prices to specific thresholds prior to uploading prices into the system of record.</p> <p>BMO should also consider updating the IPV Appendix reference regarding approved brokers. Additionally, the IPV policy and procedure documents should be formally approved and should reflect the updated price verification processes.</p>






Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	entered into a spreadsheet by each of the respective traders then uploaded into MxCom. BMO compensating controls include: 1) all futures prices are checked daily by the Back Office; 2) Futures price discrepancies would be detected the following day when calculating the exchange margin calls 3) forward prices and implied volatilities are checked twice per month to independent prices received by the Back Office.		
B8 – Integrity of Market Data Collection	<p>Market Risk determines price sources in conjunction with Front Office as documented by the ORSD. The majority of prices are independently provided to the back office based on the ORSD. Recently, for specific quotes relating to options BMO has begun to collect both consensus market data and third party broker quotes to independently verify and calculate the natural gas portfolio's valuation and corresponding reserves.</p> <p>Market Risk view differs on one point and that is it is required to contact the Front Office before requesting quotes from brokers for the specific pricing relating to options. Detail follows on differing views:</p> <p><b>Market Risk View Point:</b></p> <p>Market data is currently collected by Front Office personnel utilizing either broker quotes received from instant messages or over the phone/shout down boxes.</p> <p>Market Risk is required to contact the front office before request pricing information directly from a broker, who then obtains the data from the broker and relays the broke quote to Market Risk.</p> <p><b>Front Office View Point:</b></p> <p>There are various data sources that are provided independently to the back office at month-end to complete their price verification process. Pipeline swaps brokers are: 1) TFS; 2) ICAP; 3) Amerex; and 4) GFI. Option brokers are: 5) Manfinancial; 6) Optionable; 7) Spectron; 8) TFS; 9) Prebon; 10) Choice; and 11) United.</p> <p>Market Risk and the Front Office agreed that if Market Risk needed additional quotes at anytime during the month, that Market Risk staff get on the phone with the trader, or that the trader send an IM to a relevant broker in Market Risk's presence. In addition, Market Risk independently at the end of each month sends an options grid directly to Optionable and the grid comes back directly to Market Risk. Furthermore, Market Risk can also request ad-hoc quotes from Optionable independently, without the traders knowledge, during the month.</p> <p>In addition to all of the above, it was agreed that Market Risk will provide the traders requests for quotes and the traders will provide Market Risk the relevant IM's in Market Risk's presence.</p> <p>There was a concern that Market Risk may inadvertently advise the broker of our position, therefore, both the Front Office and Market Risk agreed to the process where the trader would assist Market Risk in</p>		<p>BMO should include context in the IPV and Official Rate Source Document stipulating Market Risk's independence with respect to the collection of market data. Independence can be defined in the following manner: 1. The Market Risk independent of the front office contacts brokers for pricing information and determines the value for pricing inputs; 2.</p> <p>The Market Risk provides requested pricing points to the front office and watches/audits the collection of requested quotes from brokers. In addition, the Market Risk determines the final value for pricing. This type of process was put in place during the Deloitte engagement at the end of February 2007.</p> <p>This ensures integrity of the market data gathered. Market risk has the final decision as to determination of value for a pricing point and always obtains the right to contact brokers independently of the front office.</p>




Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	obtaining the information that they requested.		
B9 - Confirmations (Written and Oral)	<p>Depending on the type of transaction BMO goes through several checks during the trade confirmation process.</p> <p>For futures and listed options the Front Office verbally checks each transaction with HSBC, the primary clearing broker. These trades are then reconciled by the back office the following day (T+1).</p> <p>Customer transactions are verbally confirmed with the counterparty by the Back Office on T+1. Following the verbal confirm, confirmations are faxed to the counterparty. Customers must either sign-back the BMO confirmation or send their own.</p> <p>OTC transactions executed through brokers are verbally confirmed by the respective trader. Back Office checks that transactions are verbally confirmed with the counterparty, verified against broker statements, and matched against counterparty confirmations.</p> <p>OTC transactions executed through ICE are verbally confirmed by Back Office on T+1.</p> <p>EConfirms through ICE are automatically reconciled between the Bank's transactions and the counterparty for all participating counterparties,</p> <p>BMO's process includes: 1) Trader executes the transaction; 2) Analyst enters the transaction into the system; 3) Front Office Analyst independently validates the following transactions – exchange traded and clearport transactions are verified with the clearing broker and with NYMEX clearport trade records, ICE transactions are verified to ICE, counterparty marketing deals are checked to the marketer's blotters. Traders direct deals with their brokers. The following day the back office will econfirm (electronic matching of confirmations) of approximately 40% of our transactions, reconcile all exchange traded and OTC cleared deals to our clearing broker and verbally confirm with counterparties all other deals. They will also receive confirmations and match trade details to our records. Only discrepancies between an external counterparty/exchange and our records will be escalated to the Front Office for investigation. The recordings that have been reviewed were when the counterparty did not agree with our written confirmation at which time we went back to the tapes to validate the transaction. In most circumstances, counterparties agree to our records and/or our trader will agree that he made an error on the trade ticket where the ticket is fixed immediately.</p> <p>As for ensuring that the recordings are working, the New York Telecommunications Group monitors the tape recording system during the day. They also access the recorders and listen to a few random recordings during the day to ensure the recording is working. They also have audible alarms which notify them of problems.</p>	✓	Operating policies and procedures related to Confirmations are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
B10 - Invoicing and Settlement	<p>According to the Internal Control Governance Framework the Back Office issues invoices to all of its customers/counterparties prior to making payments. Also, Back Office verbally confirms payments with Commodities Product's customers before payment.</p> <p>The Back Office independently validates and sets up customer settlement instructions. CP books all accounting entries for payments and receipts, and prepares wire transfers for payments. G/L and wire payments are independently checked by the manager, and once verified, are faxed to Montreal where they are keyed into the relevant system.</p>		Operating policies and procedures related to invoicing and settlement are consistent with Prevailing Industry Practices.
B11 - Management Reporting	<p>A monthly Management Report is prepared for executive management that summarizes all the key financial driver of the business. These reports include:</p> <ul style="list-style-type: none"> <li>▪ Balance Sheet</li> <li>▪ Notional Balances</li> <li>▪ Income Statement (current month, forecast, plan)</li> <li>▪ Economic Capital</li> <li>▪ Risk Weighted Assets</li> <li>▪ Leveraged Assets</li> <li>▪ Summary of Holdbacks (Credit, Liquidity, Mid-Bid, Administrative)</li> <li>▪ Collateral Pledged</li> <li>▪ Summary of Marketing/Trading Revenue</li> </ul>		<p>The management reports clearly illustrate certain attributes of the portfolio. However, critical portfolio attributes such as position by book, commodity, and instrument are not included in the reporting package.</p> <p>The Bank should consider adding these reports to the package and presented in a clear manner to provide easy interpretation for management and those not involved with granularities within the book. Also, consolidated P&amp;L reports indicating monthly performance by date should be considered.</p> <p>Management reports are prepared to report Financial Management information and not Risk Management information. Risk Management packages are prepared by Market Risk and sent to relevant stakeholders as specified. The Market Risk Corporate Standard should provide a list of specific reports.</p>






## C. Market Risk Management

This segment of our design assessment compared BMO's current market risk management policies to industry prevalent market policy components. Where applicable, we identified areas where BMO's policies met, could be improved or were significantly different than industry norms.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
C1 - Organizations' risk management infrastructure will always include a Market Risk Policy, which memorializes the organization's market risk related controls to mitigating the inherent risks associated with commodity transacting activities.	Market Risk published the latest version of its operating policies and procedures in October 2006. The purpose of the document is 'to outline the framework within which Market Risk is managed throughout the Bank, to ensure that all such risks associated with trading and underwriting and structural activities are identified, managed, measured, monitored, and reported.'  The Market Risk Corporate Standard outlines the processes, reporting, and monitoring activities conducted by MR to ensure portfolio risks are effectively managed.		Operating policies and procedures related to Market Risk are consistent with Prevailing Industry Practices.
C2 - At a minimum, risk policies document the structure, processes, controls, and systems to manage market risk.	The Market Risk Operating Standard defines: <ul style="list-style-type: none"> <li>the various types of risks assumed by the bank;</li> <li>the principles that govern market risk procedures;</li> <li>the management framework of Market Risk;</li> <li>outputs, such as reports, produced by Market Risk; and</li> <li>the roles and responsibilities of the Market Risk executive team.</li> </ul>		The Operating Standard should include a framework defining criteria for the selection of independent market data sources and the hierarchical approach to utilizing this data. To a certain extent, this exists in Appendix 1 – Source and Variance Tolerance Grid of the Official Rate Source Document. However, only one broker, Optionable, is listed for Gulf Coast, Mid Continent, and West Coast options and swaptions. The document should reference at least two additional independent pricing sources for each instrument and pricing location.
			The Market Risk Management Standard should include references to systems containing data that are an input to any Market Risk processes. Also, the roles of systems and/or risk engines utilized by Market Risk for valuations should be clearly defined and vetted in the standard. Also, the standard should specify a Bank-wide approach for sourcing illiquid market data and the use of broker quotes and consensus data.
C3 - Organizations design one comprehensive Market Risk Policy to make the maintenance and administration responsibilities more manageable.	The original Market Risk Corporate Policy was published in June 1998. Since then the policy remains a single document, updated and maintained on a periodic basis.  A Market Risk Management Standard is issued in conjunction with the Corporate Policy.		Operating policies and procedures related to Market Risk are consistent with Prevailing Industry Practices.
C4 - Once a market policy is approved, all relevant transacting personnel are required to acknowledge in writing that they have been informed of and understand the policies. The policies and amendments should be announced in a timely manner and be readily accessible to each employee by hard or electronic copy. All relevant trading personnel should be required to reaffirm the policies annually.	Traders, and subsequently each portfolio, receive and must provide acknowledgement of authority letters, which include all delegated trading limits, on an annual basis within 30 days of receiving notification of the limits.  These letters stipulate VaR and Stress test, position and tenor limits for primary for primary limits. Secondary limits are also included in the letter, such as concentration and loss reporting limits.  Trader authority letters also provide a list of authorized products for each portfolio and		Operating policies and procedures related to Market Risk are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	general transacting guidelines.		
<p>C5 - A comprehensive market policy should include, at a minimum:</p> <ul style="list-style-type: none"> <li>a market risk tolerance statement and policy objectives;</li> </ul>	<p>The objectives of the Market Risk Corporate Policy and Market Risk Management Standard are expressed in the Introduction and Principles section of each document. Market risk limit definitions are stated in each.</p>		<p>BMO should consider adding a clearly defined market risk tolerance statement in the Market Risk Management Standard before Market Risk Limits in the Market Risk Framework section, and should also precede each market risk limit in corresponding authority letters.</p>
<ul style="list-style-type: none"> <li>identification of market risk exposures (e.g., price, basis, volatility, correlation), sources and mitigation techniques;</li> </ul>	<p>Exposure is divided into seven separate sections in the standard.</p> <p>Market Risk – risk of value impairment and /or income loss to the Enterprise resulting from adverse changes in the price or value of open or unhedged market positions</p> <p>Structural – Interest rate risks related to consumer, commercial and corporate asset and liability mismatches and embedded options; interest rate risk related to the investment of common shareholder's equity; and foreign exchange risk from net income in foreign currencies.</p> <p>Trading and Underwriting – All actively bought and sold positions that are accounted for on a mark-to-market basis; positions that are not accounted for on a mark-to-market basis but, for risk management purposes, are considered as trading positions; and investment portfolios;</p> <p>Market Value Exposure – measure of the adverse impact of changes in market parameters on the market value of a portfolio of assets, liabilities and off-balance sheet positions over a specified holding period.</p> <p>Earning Volatility – measure of the adverse impact of changes in market parameters on the projected 12-month after-tax net income of a portfolio of assets, liabilities and off-balance sheet positions.</p> <p>Stress Test Exposure – measure of the adverse impact of scenarios represented by sets of stressed changes in market parameters on the market value of the assets, liabilities and off-balance sheet positions in a portfolio.</p> <p>Mark to Model – valuation of a position that is benchmarked, extrapolated or otherwise calculated from market input because prices for the instruments are not readily observable in the marketplace.</p>		<p>BMO should consider elaborating on the Market Risk Management Standard regarding the types of risks taken on by the commodities desk, and align these risks with mitigation techniques adopted by the Bank's Risk Management Committee. Since each trading book differs fundamentally the risks inherent with each book should be described individually.</p>
<ul style="list-style-type: none"> <li>delegated market risk authorities and approvals, including clearly defined market risk personnel roles and responsibilities, reporting lines and an illustration of the market risk organization structure;</li> </ul>	<p>All signatories having responsibility in the LOB under delegated limits will acknowledge in writing within 30 days from the date that RMC has approved the limits.</p>		<p>Operating policies and procedures related to market risk personnel roles and responsibilities are consistent with Prevailing Industry Standards.</p>







Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
– The market risk assessment methodology including value at risk; stress testing and scenario analysis	<p>The Market Risk Corporate Standard provides risk definitions for:</p> <p>VaR limits – 1 day loss in value based at a 99% confidence level</p> <p>Stress limits – measurement of the worst case stress scenario at approximately 99.95% or higher confidence</p> <p>Greek/position limits – applicable to both linear and non-linear positions</p> <p>Traded credit limits – the TCR Corporate Standard defines the minimum criteria for qualification</p> <p>Market value exposure limits – calculated on an undiversified basis using a 99% confidence level and a holding period of two calendar weeks for investment grade and one calendar month for sub investment grade portfolios.</p>		Consistent with prevailing practice details provided in the model approval matrix
– Model Testing Approach	Following methodology changes related to risk bucketing, seasonality, and changing the rollover window to the VaR calculation the Bank intends to test and verify the enhancements in parallel with the old methodology for six non-consecutive days.		BMO should consider lengthening its testing phase after making adjustments to the NVaR system. The six days non-consecutive approach is acceptable but does not meet prevailing industry practices for risk model testing. Prevailing testing practice constitutes 30 consecutive business days over 2 roll periods (standard minimum practice). This allows for a broader perspective to capture more types of transactions or changes in portfolio composition.
– Skew calibration process	<p>BMO's current skew calibration process entails the following steps:</p> <ol style="list-style-type: none"> <li>1) Obtain the straddle's market quotes</li> <li>2) Input the ATM implied volatilities from Step 1 in the Skew Calibration spreadsheet</li> <li>3) Set the strike equal to the price at one standard deviation (1-SD) of the current underlying calculated in the Skew Calibration spreadsheet</li> <li>4) Obtain the market quotes from the OTM options at the 1-SD strike and derive the OTM implied volatility (IV) at the 1-SD strike</li> <li>5) Calculate the "vol diff" (difference between OTM IV above and ATM IV)</li> <li>6) Use the Fit_Skew_Vb function to derive Skew, Wings, and Boost values by using "vol diff" and other required inputs for Fit_Skew_Vb function</li> <li>7) Adjust the Boost value (without changing Skew and Wings from step 6) such that the volatility curve "best fits" other than the 1-SD implied volatility such that implied volatilities at those other strikes would lie within the Bid-Ask spreads of the quotes.</li> </ol>		<p>The current BMO skew calibration process is relatively informal. The Bank should consider creating documentation to formalize this process and vet for reasonableness. Prevailing practice is for the middle office to vet month end skew calibrations as executed by the front office based upon a documented methodology.</p> <p>No prevalent practice exists as to how often skew calibration is executed and vetted <i>within</i> a month.</p>
– Document retention and file standards;	The Line of Business is responsible for the retention of all authority letters following confirmation.		BMO is consistent with prevailing practice as it has bank standard data retention methods, such as electronic or physical storage, security measures, other file standards and web documents.
– Market risk reporting standards including report owner, frequency, and distribution;	<p>Market Risk provides reporting measurements for the following risk measures at the specified frequencies:</p> <ul style="list-style-type: none"> <li>▪ <i>Market Value Exposure, one day at 99% confidence</i> – daily for Trading and Underwriting Portfolios and monthly for</li> </ul>		Operating policies and procedures related to risk reporting standards are consistent with Prevailing Industry Standards.



Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<p>Structural Portfolios;</p> <ul style="list-style-type: none"> <li>Stress Test Exposure at approximately 99.95% or higher confidence on a one day holding period – daily for Trading and Underwriting Portfolios and monthly for Structural Portfolios;</li> <li>Greek/Position Reports – applied to linear and non-linear positions in the currency specified.</li> </ul> <p>Depending on the portfolio Market Risk or Corporate Treasury provides copies of the reports to the respective LOBs, and Finance provides official P&amp;L reports on a daily basis.</p>		
– Code of ethics and conduct and non-compliance policy;	<p>Appendix 2 of the Market Risk Corporate Standard details the processes undertaken following a breach of trading and underwriting market risk primary limits.</p> <ul style="list-style-type: none"> <li>The first excess in the fiscal year requires an explanation from the trading professional to the LOB Head;</li> <li>the second excess may require a formal presentation to the MRC</li> <li>the third excess in the fiscal year results in disciplinary action from the LOB Head, including possible financial repercussions and up to dismissal.</li> </ul>	✓	Operating policies and procedures related to code of ethics and non-compliance are consistent with Prevailing Industry Practices.
– Policy maintenance and administration requirements; and	All employees of Market Risk with roles and responsibilities related to management or oversight of market risk in structural or trading and underwriting activities contribute to maintaining an effective market risk management framework.	✓	Operating policies and procedures related to policy and standard maintenance and administrative requirements are consistent with Prevailing Industry Practices.
– Employee acknowledgement and reaffirmation requirements.	<p>All signatories having responsibility in the LOB under delegated limits will acknowledge in writing within 30 days from the date that RMC has approved the limits, that they have read and understood the contents of the limit letter.</p> <p>During RMC meetings the Committee reviews and recommends for onward approval, Corporate Policies, and all limits to be delegated by the Board of Directors to the Chief Executive Officer.</p> <p>Authority letters are reaffirmed annually.</p>	✓	Operating policies and procedures related to employee acknowledgement and reaffirmation requirements are consistent with Prevailing Industry Practices.

## D. Credit Risk Management

This segment of our design assessment compared BMO's current market risk management policies to industry prevalent credit policy components. Where applicable, we identified areas where BMO's policies met, could be improved or were significantly different than industry norms.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
D1 - Organizations' risk management infrastructure will always include a credit risk policy, which memorializes the organization's credit risk related controls to mitigating the inherent risks associated with commodity transacting activities.	The "policy" guidance governing the management of credit risk associated with the energy commodity transacting business at BMO is contained in multiple documents existing at three levels:  Policies/Standards: Providing highest level guidance regarding credit risk management requirements, typically applicable across multiple business lines.  Guidelines: Relatively brief documents, providing general guidelines regarding credit risk requirements.  Lending/Financing Papers: Providing more detailed information regarding credit risk management requirements for specific lines of business.		The combination of credit risk management guidance contained across policy document levels is quite extensive, and taken together is consistent with Prevailing Industry Practices.
D2 - At a minimum, risk policies document the structure, processes, controls, and systems to manage credit risk.	BMO credit policy documents as described above, in total, document relevant structure, processes, controls and systems required to manage credit risk associated with the energy commodity transacting business line.		Existing practices are consistent with Prevailing Industry Practices.
D3 - Organizations design one comprehensive credit risk policy to make the maintenance and administration responsibilities more manageable.	As mentioned above, credit policy guidance governing the management of credit risk associated with the energy commodity transacting business at BMO is contained in multiple documents existing at the policy/standards, guidelines and lending/financing papers levels. Credit and transacting professionals are required to consult a number of different sources of guidance across these document levels to obtain a view of the total requirements for managing credit risk for the energy commodity transacting business.		In order to gain a clear understanding of BMO credit policy applicable to the commodity transacting business, the reader must review a large number of policies/standards, guidelines and lending/financing papers, each of which addresses specific aspects of required credit risk management. While the breadth and depth of guidance is consistent with Prevailing Industry practice, the absence of a single reference point at which individuals involved in transacting and credit risk management within the energy commodity business can review and understand credit requirements may negatively impact efficiencies related to training new employees, ongoing policy maintenance, employee re-affirmation, etc. BMO should consider the development of a single reference document which summarizes required credit practices for this purpose.
D4 - Once a credit policy is approved, all relevant transacting personnel are required to acknowledge in writing that they have been informed of and understand the policies. The policies and amendments should be announced in a timely manner and be readily accessible to each employee by hard or electronic copy. All relevant trading personnel should be required to reaffirm the policies annually.	All credit risk management policies are maintained in BMO's intranet, and are available to all transacting employees. When amendments to existing policies are introduced, transacting employees are notified via the intranet that such changes have occurred, and directed to read the new documentation. Transacting employees sign an annual statement of compliance with BMO's Ethical Standards and Compliance Guidelines, which contain general references to credit risk management requirements.		BMO may wish to consider establishing a process by which transacting personnel are required to review and provide written acknowledgment of changes to credit risk management guidance which are issued during the year.  BMO may wish to consider strengthening the language contained in the Ethical Standards and Compliance Guidelines statement related to compliance with credit risk management practices, to more directly address key compliance actions required of transacting personnel.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
D5 - A comprehensive market policy should include, at a minimum: – a credit risk tolerance statement and policy objectives;	IBG Financing Guideline; Commodity Derivative Products, effective October 2006 provides general guidelines relevant to risk tolerance at the individual counterparty level.  The Commodity Derivative Products Financing Paper establishes clear limits for unsecured credit by risk rating class.	✓	Existing practices are consistent with Prevailing Industry Practices.
– identification of credit risk exposures (e.g., current and potential future exposure), sources and mitigation techniques;	The Commodity Derivative Products Financing paper in section 9.0 Exposure Monitoring, establishes the requirement to calculate and track both current exposure and future potential exposure as well as capital at risk.	✓	Existing practices are consistent with Prevailing Industry Practices.
– delegated credit risk authorities and approvals, including clearly defined credit risk personnel roles and responsibilities, reporting lines and an illustration of the credit risk organization structure;	IBG – Risk Rating Assessment, release 4.2, dated December 2005 identifies a summary of key roles and responsibilities for the risk rating process.  IBG Financing Guideline – IBG Trading Products, effective May 2005 identifies authorization levels and approval requirements for non-standard terms	✓	Existing practices are consistent with Prevailing Industry Practices.
– The credit risk assessment methodology including value at risk; stress testing and scenario analysis	IBG – Risk Rating Assessment, release 4.2, dated December 2005 identifies the approved counterparty risk assessment process. BMO's existing process incorporates the analysis of both historical and forecasted financials, external and internal model based statistical default and loss data; market relevant qualitative and quantitative data and the evaluation of key qualitative entity data. The analysis of these data result in the development of an initial risk rating, which is reviewed and finalized by qualified credit officers, prior to granting a line of credit. Risk ratings are mapped to a probability of default which, along with key loss data, is used to determine capital at risk, which is in turn subject to the Bank's capital allocation requirements under prevailing regulation.	✓	Existing practices are consistent with Prevailing Industry Practices.
– Acceptable forms of credit support (credit enhancement);	IBG Financing Guideline – Capital Markets – Collateral Management document dated December, 2005 identifies detailed practices to be used in the management of collateral. Exhibit 1 to this document lists approved forms of collateral, along with valuation haircut guidelines by collateral type.	✓	Existing practices are consistent with Prevailing Industry Practices.
– Document retention and file standards;	The commodity transacting business is required to adhere to the documentation and retention standards established across all business lines by BMO's Documentation group. Original files are maintained in a secure environment by this central group, while "working copies" of key documents are maintained by credit personnel supporting the energy commodity transacting business. In addition, credit personnel use "Centerpoint", an electronic desktop to access electronic copies of credit files, term sheets, the risk rating evaluation, the credit approval records, etc.	✓	Existing practices are consistent with Prevailing Industry Practices.
– Credit risk reporting standards including report owner, frequency, and distribution;	Corporate Standard, Market Risk; Traded Credit Risk, effective November 2005 establishes Market Risk as responsible for the daily monitoring of credit and for the reporting of credit risks. Market Risk is responsible for the development of management reports" for sharing key credit	✓	Existing practices are consistent with Prevailing Industry Practices.  As noted above, BMO may want to consider strengthening the language contained in the Ethical Standards and Compliance Guidelines to more directly address key compliance actions required.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<p>risk information with management.</p> <p>Credit exposure data is maintained in "Adaptive", BMO's credit risk management system. Adaptive recalculates and updates key credit risk management information each evening based on the day's trading activities. Each morning, the credit personnel supporting the energy commodity transacting business extracts and distributes to all transacting personnel, updated credit risk management information from Adaptive.</p> <p>The extract contains the list of approved counterparties, and for each counterparty, their risk rating, maximum allowed tenor, limits and available credit, along with other key data. The extract is color coded so that counterparties with no available limit appear in "red", and counterparties with existing exposures nearing the available limit appear in "yellow".</p>		address key compliance actions required of transacting personnel.
– Code of ethics and conduct and non-compliance policy;	<p>Each person involved in BMO's energy commodity transacting business is required to sign an annual "Ethical Standards and Compliance Guidelines" statement acknowledging key requirements, and agreeing to adhere to them. This statement includes general language related to compliance with credit risk management requirements.</p> <p>Non-compliance with credit guidance at the transacting level is flagged by the Adaptive system. The policy for non-compliance is well documented, with clear guidance requiring escalation and review.</p>	✓	Existing practices are consistent with Prevailing Industry Practices.
– Policy maintenance and administration requirements; and	<p>BMO's credit organization is responsible for the updating and maintenance of all level of credit policy guidance affecting BMO's energy commodity transacting business. Updates occur most frequently at the lending/financing papers level and at the guideline levels.</p>	✓	Existing practices are consistent with Prevailing Industry Practices.
– Employee acknowledgement and reaffirmation requirements.	<p>As noted above, each person involved in BMO's energy commodity transacting business is required to sign an annual "Ethical Standards and Compliance Guidelines" statement acknowledging key requirements, and agreeing to adhere to them. This statement includes general language related to compliance with credit risk management requirements.</p>	✓	The annual re-affirmation of compliance by employees is consistent with Prevailing Industry Practice.

## RISK MANAGEMENT CONTROLS OPERATING EFFECTIVENESS

To facilitate effective risk management controls, certain risk management infrastructure categories should not only be designed and in place, but also operate consistently. For purposes of this assessment, our evaluation focused on three primary risk categories: Risk Management Governance, Transacting Control, and Market Risk Measurement and Management. These categories are the first tier of the risk framework hierarchy and are part of a well designed risk infrastructure. Each category is comprised of risk control activities that when grouped together form a discrete group of risk control *components*. Components form the second tier of the risk framework hierarchy and are the fundamental business practices that establish a sound risk management foundation and determine operating effectiveness. Deloitte & Touche selected a comprehensive set of risk control components that apply to the current nature, size and complexity of BMO's energy commodity transacting function and related transaction activity support areas.

The risk control components aligned by each high-level category are shown in Table 2 below.

**Table 2**

Risk Management Governance	Transactional Controls	Market Risk
<ul style="list-style-type: none"> <li>▪ Risk Management Committee</li> <li>▪ Roles &amp; Responsibilities</li> <li>▪ Book Structure</li> <li>▪ Qualitative Limits</li> <li>▪ Quantitative Limits</li> <li>▪ Exposure Monitoring</li> <li>▪ Reporting</li> <li>▪ Code of Conduct</li> </ul>	<ul style="list-style-type: none"> <li>▪ Pre-Deal Processes and Authorization</li> <li>▪ Deal Execution</li> <li>▪ Deal Capture</li> <li>▪ Deal Entry Validation</li> <li>▪ Contract Administration</li> <li>▪ Confirmation</li> <li>▪ Settlements</li> </ul>	<ul style="list-style-type: none"> <li>▪ Market Data Sourcing - Liquid</li> <li>▪ Market Data Sourcing - Illiquid</li> <li>▪ Valuation (Mark-to-Market)</li> <li>▪ Liquidity Reserves</li> <li>▪ Probabilistic Risk Measures</li> <li>▪ Sensitivity Analysis</li> </ul>

### A. Risk Management Governance

Risk Management Governance, as a broad risk category, is comprised of the following control components:





1. Risk Management Committee
2. Roles and Responsibilities
3. Book Structure
4. Qualitative Limits
5. Quantitative Limits
6. Exposure Monitoring
7. Reporting
8. Code of Conduct

Deloitte & Touche assessed BMO's current approach for each control component against prevailing industry practices and the corresponding findings and recommendations are presented below.



Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<b>1. Component: Risk Management Committee ("RMC")</b>			
1.1 - Comprised of members from Management that are familiar with and have a detailed understanding of energy activities and their associated risks. RMC members may include: <ul style="list-style-type: none"> <li>Independent Risk Manager</li> <li>Chief (Executive) Administrative Officer</li> <li>Chief Financial Officer</li> <li>Head of Transacting</li> <li>Middle and Back Office Functions</li> </ul>	BMO's Risk Management Committee is comprised of the following functional areas and roles: <ul style="list-style-type: none"> <li>CEO and Chairman (Ex-Officio)</li> <li>Enterprise Risk and Portfolio Management (Chair and members)</li> <li>Banking Groups (Vice-Chair and members)</li> <li>Finance Group (members)</li> <li>Also, The Executive Vice-President and Head, Corporate Risk Management will appoint one or two CRM executives to the role of Secretary (non-member).</li> </ul>	✓	Based on our review of BMO's Risk Management meeting minutes, BMO's Risk Committee meetings have the correct representation from various member and attendee constituents.
1.2 - The RMC is responsible for understanding of risk management concepts	RMC and its sub-committees serve as a forum to review, inform, consult, discuss, where appropriate, and approve, if stipulated in their mandate, significant risk issues and action plans addressing current and emerging risks that arise in the course of executing the Bank's strategy.	✓	Based on our review of BMO's Risk Management meeting minutes, BMO's Risk Committee member's and attendees appear to have an understanding of pertinent risk management concepts and practices for oversight of the energy commodity product line.
1.3 - The RMC should be responsible for setting corporate policies and guidelines for risk management and measurement	RMC will review and recommend Corporate Policies, major initiatives, limits and other control mechanisms, where required, to manage the Bank's risk profile within approved strategies and Corporate Policies, before they are forwarded to RMC for final approval, as needed.	✓	Based on our review of BMO's Risk Management meeting minutes and RMC Mandate, BMO's Risk Committee members are involved in actively setting bank policies and guidelines for risk measurement and management.
1.4 - The RMC is responsible for overseeing and reviewing the risk management process and infrastructure.	RMC is the senior risk committee of the Bank for Credit and Counterparty Risk including Insurance Risk, Market Risk, Operational Risk, Liquidity and Funding Risk, Business Risk, and Integrated Risk. This ensures that oversight governance is brought to the highest levels of executive management.	✓	Based on our review of BMO's Risk Management meeting minutes and RMC Mandate, BMO's Risk Committee member's are actively involved in overseeing and reviewing the commodity product lines risk management process and support infrastructure.
1.5 - The RMC is responsible for reviewing and approving risk limits	The Committee reviews and recommends for onward approval, Corporate Policies, and all limits to be delegated by the Board of Directors to the Chief Executive Officer.	✓	Based on our review of BMO's Risk Management meeting minutes and RMC Mandate, BMO's Risk Committee members are actively involved in reviewing and approving risk limits and limits excessions.
1.6 - The RMC is responsible for ensuring that proper controls are in place	RMC will review and recommend Corporate Policies, major initiatives, limits and other control mechanisms, where required, to manage the Bank's risk profile within approved strategies and Corporate Policies, before they are forwarded to RMC for final approval, as needed.	✓	Based on our review of BMO's Risk Management meeting minutes and RMC Mandate, BMO's Risk Committee members are actively involved in ensuring that proper controls are in place.
1.7 - The RMC is responsible for understanding and approving methodologies used to measure and control risk taking	The Committee ensures that all risk taking activities are within the risk appetite and limits granted to the CEO from the Board of Directors and delegated to the Deputy Chair, Enterprise Risk and Portfolio Management (ERPM).	✓	Based on our review of BMO's Risk Management meeting minutes and RMC Mandate, BMO's Risk Committee members are actively involved in understanding and approving methodologies used to measure and control risk taking activities.
1.8 - The RMC is responsible for reviewing and approving exceptions and amendments to policies	The Committee will review the following to assess the Bank's risk profile in relation to executing the Bank's strategy: <ul style="list-style-type: none"> <li>Credit and counterparty risk issues</li> </ul>	✓	Based on our review of BMO's Risk Management meeting minutes and RMC Mandate, BMO's Risk Committee members are actively involved in reviewing and approving exceptions and amendments to policies. On





Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<ul style="list-style-type: none"> <li>Market risk – including allocation of limits to risk-taking units</li> <li>Operational risk</li> <li>Integrated risk</li> <li>The management of Liquidity and Funding Risk across the enterprise.</li> <li>The management of Business Risk across the enterprise.</li> </ul>		several specific occasion, limit letter were generated, reviewed and signed by delegated personnel responsible for reviewing and approving amendments to trading limits.
1.9 - The RMC is responsible for evaluating portfolio risk.	The Committee reviews and confirms the Bank's risk profile in the Quarterly Report Attestation in accordance with Risk Management Policy (CP 0202-17).	✓	Based on our review of BMO's Risk Management meeting minutes and RMC Mandate, BMO's Risk Committee members are actively involved in evaluating the various trading portfolio risks as presented by BMO Risk Management attendees.
1.10 - The RMC is responsible for meeting as least monthly or more frequently as necessary to discuss risk management related items.	The Committee will convene a minimum of eight times annually usually excluding calendar quarter-end months (i.e. December, March, June, and September). Information packages will be distributed monthly.	✓	Based on our review of BMO's Risk Management meeting minutes and RMC Mandate, BMO's Risk Committee members meet on a monthly basis or more frequently as necessary to discuss several standard and relevant agenda topics.
<b>2. Component: Roles and Responsibilities</b>			
2.1 - Organizations should have clearly delineated roles and responsibilities by functional area	<p>The roles and responsibilities of functional groups at BMO are generally described as follows:</p> <ul style="list-style-type: none"> <li>Management: responsible for the management of the trading and sales functions for the CP group.</li> <li>Trading: responsible for supporting trading activities including pricing, modeling and structuring deals, hedging, and developing trading strategies.</li> <li>Marketing: responsible for the marketing of the CP group's products and services.</li> <li>Structuring: responsible for identification and quantification of commodity exposures and to provide specific and innovative risk management strategies and products to manage those exposures.</li> <li>Front Office Operations: responsible for supporting the existing CP trading team and day-to-day activities.</li> <li>Market Risk: responsible for providing detailed independent analysis, commentary and where warranted and appropriate, concurrences to key market/traded credit risk exposures.</li> <li>LPG, International and bank Credit Group: responsible for a portfolio of Treasury facilities and loans made on behalf of the CP group.</li> <li>Back Office: responsible for providing end-to-end trade processing for OTC and Exchange Traded products executed by the Front Office.</li> </ul>	✓	Existing practices are consistent with Prevailing Industry Practices.
2.2 - Organizations should have clearly delineated authorities and approvals by functional area	<p>The Division of Duties defined by BMO discusses and assigns the following duties:</p> <ul style="list-style-type: none"> <li>Authorization – Front Office – the process of reviewing and approving transactions and operations</li> <li>Custody – Back Office – having access to or control over any physical asset</li> </ul>	✓	Existing practices are consistent with Prevailing Industry Practices.




Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<p>such as cash, check, equipment, supplies, or materials</p> <ul style="list-style-type: none"> <li>Record Keeping – Back Office – the process of creating and maintaining records of revenues, expenditures, inventories, and personnel transactions.</li> <li>Reconciliation – Market Risk and Back Office – verifying the processing or recording of transaction to ensure that all transactions are valid, authorized and recorded on a timely basis</li> </ul>		
2.2 - Organizations should communicate roles and responsibilities across functional groups to promote transparency of duties.	The Bank has created specific documentation giving details around roles and responsibilities of functional groups. However, as several key Market Risk responsibilities take place in New York, while others take place in Toronto, other groups find it creates a perception of non-communication between the two regions.		BMO should consider addressing roles and responsibilities during a formal exchange to resolve an existing disconnect between Market Risk duties in Toronto and New York and the Front Office.
2.3 – A limited number of organizations have dedicated risk groups at the business level whose responsibilities among other things are to develop VaR methodology that is effective in capturing certain risks specific to the commodity business. Such risks may not be applicable to other asset classes and thus underscore the VaR measures produced by the bank-wide VaR methodology. Procedures are developed to ensure that the business-level risk group works with the corporate risk group to resolve any discrepancies between measures produced by different methodologies. A risk attribution analysis, which provides into the portfolio risk profile by decomposing VaR measures into meaningful granularity such as commodities, instruments, locations, tenors, and Greeks, may be conducted to facilitate the discrepancy resolution process.	BMO utilizes a corporate risk governance group. No dedicated risk group exists.		<p>BMO should consider the creation of this group, as it is becoming more prevalent in the industry. BMO must be careful in organizational setup and responsibilities if it decides to setup such a group. A business side risk group has no authority over pricing, models, valuations, risk measurement, limits or limit monitoring these tasks stay with a centralized risk function. In addition, the business risk group has a dotted line to both front and middle office heads. The purpose of this group is to provide more analysis of risk of transactions for the front office and to better communicate the implications of a deal on risk. In addition, this group will consult with centralized risk groups on levels of risk inherent in the portfolios.</p> <p>A business side risk group works well in organizations where the front and middle office already have a well defined working relationship.</p>
<b>3. Component: Book Structure</b>			
3.1 - Organizations with varying transacting activities should have a Book Structure that segments the corporate transacting portfolio into sub-portfolios, according to the role of the transactions in the business strategy, and the risks inherent in that transacting strategy.	<p>The BMO book structure is segregated by products, and the traders responsible for those products.</p> <p>Specific book names and traders can be found in the Commodity Products Groups Operations Procedure Manual in section 3.3.1.1, version 3.1 dated 18 December 2006.</p>		Existing practices are consistent with Prevailing Industry Practices. Given the traders own the risk of marketing transactions as they have the transaction in the trading book. The traders manage the risk.
3.2 - The Risk Policy contains a description of transactions to be included in each book, practices for transferring transactions from one book to another, and approval required to create a new book.	<p>Contained within each designated authority letter is a table describing product and contract types, and descriptions of transactions permissible for the respective book.</p> <p>The MRC operating policies and procedures state that "Prior to opening any new portfolios/transits in either the general ledger and/or product system, it is the responsibility of the desk to confirm with Market Risk, Finance, and Operations that they can be incorporated into the booking systems, VaR and BOD structures."</p>		Trader limit letters stipulate their trading authority and approved products. Traders may execute transactions between themselves under varying circumstances: 1) all fixed price transactions are executed by one trader. If another trader requires a fixed price swap to hedge an option position, they will execute with the fixed price trader rather than go to external market participants; 2) during the day trader's individual risk positions may be offsetting and the traders may want to flatten their risk against each other rather than go to external market participants and pay the bid-offer spread. From a overall group's perspective, no internal transactions are recorded in the Bank's accounting records as they offset.



Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
3.3 - Those responsible for executing transactions appropriately designate the correct book when the transaction is entered into.	Trading professionals complete trade blotters related to their corresponding book. Front Office analysts then recognize the book by the trader name and trade blotter.		Currently, all products (except CAD crude trades) and all trades are reversed at day end from the "Crude New" portfolio and re-assigned as follows: <ul style="list-style-type: none"> <li>Petroleum Products</li> <li>Crude OTC</li> <li>Crude Exchange Traded</li> <li>Products – Gasoline, Fuel Oil, Heating Oil</li> <li>Foreign Exchange</li> </ul> In order to streamline this process it is recommended that trades be designated and entered directly into their corresponding portfolio at the time of execution.
<b>4. Component: Qualitative Limits</b>			
4.1 - Qualitative limits define the commodities, geographic locations, instrument types and tenors that are approved for trading.	Authority letters stipulate the approved currencies and guidelines regarding limits. These letters set forth what products the portfolio is restricted and to transact and may hold positions in, including settlement types and maturities.  Letters include primary and secondary limits addressing commodity and product type, instrument, tenors, and regions.	✓	Existing practices are consistent with Prevailing Industry Practices.
4.2 - The limits are approved by the RMC, and typically are contained in the Risk Management Policy. Adding products to the approved list is controlled by a "New Product Approval Process".	Risk limits are approved by the RMC, which also reviews strategies, new products and initiatives where required by Change Management.	✓	Existing practices are consistent with Prevailing Industry Practices.
<b>5. Component: Quantitative Limits</b>			
5.1 - Quantitative limits exist such that exposures are monitored and reported against the limits, so that senior management can assess compliance with the stated risk tolerance.	Quantitative limits are expressed and defined in each individual authority letter. Market risk limits are categorized as primary (limits that have been identified by Market Risk as required to effectively control the risks associated with the LOB), or secondary, limits that are used by the LOB and Market Risk to flag levels of risk. Primary limit exceptions are logged and tracked by Market Risk and are advised to the Market Risk Committee. Exceptions must also be reported to the Line of Business Head.	✓	Existing practices are consistent with Prevailing Industry Practices.
5.2 - The RMC should expect the transacting function to manage exposures so that they stay within limits at all times, or else explain why it is not possible to remain within the limits. These limits would have application for all aspects of an organization's transacting risk.	When anticipated that a primary market risk limit will be breached, the MRC operating policies and procedures require that the responsible party seek to obtain pre-approval from both the trading manager and Market Risk. Upon the first excess of the breach, the trading professional is required to explain the cause to the LOB head, and may be required to prepare a formal presentation to the Market Risk Committee on the second breach of a primary limit. Following the third breach, the LOB head must decide on disciplinary action to pursue.	✓	Existing practices are consistent with Prevailing Industry Practices.
5.3 - Quantitative limit structures specify the risk limits for each sub-portfolio. The limits include, but are not limited to: <ul style="list-style-type: none"> <li>"At Risk" Measures (i.e. VaR) by commodity, geography, and tenor;</li> <li>Position and Greek limits on net and <del>capital loss positions</del></li> </ul>	BMO has the following limit structures currently in place.  At the group (CDG) level, VaR, Stress and Greek/Position (Delta and Vega "lagged" limits on a Net basis and "unlagged" on a Gross basis for Natural Gas and Crude Oil are used as Primary Limits. Secondary		As BMO expands its commodity business into other commodities and/or geography, BMO should consider having VaR limits by commodity, geography, and tenor. In the future as BMO enters into physical positions it should consider distinguishing between physical and financial limits.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<p>nominal open positions applied across commodity, tenor, and Markets/Regions;</p> <ul style="list-style-type: none"> <li>• Tenor/Duration limits on transactions;</li> <li>• Limits associated with stress testing; and</li> <li>▪ Loss limits.</li> </ul>	<p>Limits are Daily and Monthly Loss limits. Tenor limits are embedded in description of Authorized Products.</p> <p>At the desk level, there are no VaR and Stress limits formally assigned to each desk. The desk-level Primary Limits include:</p> <ul style="list-style-type: none"> <li>▪ Aggregate Net Lagged and Gross Unlagged Delta and Vega Limits</li> <li>▪ Net Long/Short Lagged Delta and Vega by Pipelines</li> <li>▪ Net Long/Short Lagged Delta and Vega by Seasons for the first 2 month and the front season (Tenor Limits)</li> <li>▪ Net Long/Short Lagged Delta Physical Limits</li> </ul> <p>The desk-level Secondary Limits include:</p> <ul style="list-style-type: none"> <li>▪ Concentration limits expressed in Net Long/Short "Lagged" Delta and Vega as applicable by Tenor (Seasons)</li> <li>▪ Daily and Monthly Loss limits</li> </ul>		<p>Although there is no standard practice, a number of institutions and energy firms use "unlagged" Greeks for Position limits and particularly for the Concentration limits. The rationale is that the Concentration limits aim at restricting the size of the positions on a given tenor (unlagged) and should be not contaminated with the decay/lag factors to derive "lagged" positions.</p> <p>In addition, gross delta and vega limits which net across buckets need to account for the proximity or relationship between buckets in creating the offset. In other words, in determining the amount of an offset BMO needs to account for the correlation between the buckets, i.e. for two nearby buckets one would expect a higher degree of offset than for buckets with a broader time frame between the buckets. In addition, the gross delta and vega need to net within trader buckets and across traders within a bucket for a given point.</p> <p>The majority of the firms contacted utilized the gross delta and vega limits as informational limits not hard limits. If breaches occur discussions between the front and mid will take place but no action is formally required on a breach of this type of limit. Instead an agreement is reached between the front and middle office and documented.</p>
<b>6. Component: Exposure Monitoring</b>			
6.1 - Organization's should monitor current risk exposure versus limits on a daily basis	<p>At the conclusion of each trading day Front Office analysts, in conjunction with Credit, assess the books credit and counterparty risk exposure and report any exceptions to management and traders.</p> <p>Other exposures are tracked by Market Risk on a daily basis and exceptions are also reported to line management and heads.</p>		Existing practices are consistent with Prevailing Industry Practices.
6.2 - Risk Reports are distributed to business unit senior management and to the RMC on a regular basis (usually daily, weekly or monthly, as required).	<p>Market risk exposures are reported to the following stakeholders at different frequencies:</p> <ul style="list-style-type: none"> <li>▪ Line of Business</li> <li>▪ Market Risk Committee</li> <li>▪ Balance Sheet Management Committee</li> <li>▪ Risk Management Committee</li> <li>▪ Risk Review Committee of the Board</li> <li>▪ Harris Financial Corp. Board</li> <li>▪ Regulators (OSFI, Federal Reserve, etc.)</li> </ul>		Existing practices are consistent with Prevailing Industry Practices.
6.3 - The RMC is informed immediately when an exposure exceeds the approved limit. The committee meets on a same day basis to assess the situation and provide instructions on bringing the position into compliance. They also monitor the execution of the instructions to bring the exposure back within limits.	<p>Following the first excession of a market risk limit traders must justify/explain to the Line of Business head the reasons and economics behind the violation.</p> <p>If another excession occurs within the fiscal year, traders must again report to the LOB head, but may also be required to make a formal presentation to the MRC, which is part of the Risk Committee Structure.</p>		Existing practices are consistent with Prevailing Industry Practices.
<b>7. Component: Management Reporting</b>			
7.1 - Management reports represent the primary communication statements used by an organization to convey aggregated (i.e., consolidated) commodity risk	<p>The monthly management reports prepared by BMO include:</p> <ul style="list-style-type: none"> <li>▪ Balance Sheet</li> </ul>		The management reports clearly illustrate certain attributes of the portfolio. However, critical portfolio attributes such as position by book, commodity, and instrument are not

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
exposures and business unit performance to executive management and the RMC. A meaningful package of management reports will summarize portfolio positions, market and credit exposures against limits, financial performance, and probabilistic risk measurement.	<ul style="list-style-type: none"> <li>Notional Balances</li> <li>Income Statement (current month, forecast, plan)</li> <li>Economic Capital</li> <li>Risk Weighted Assets</li> <li>Leveraged Assets</li> <li>Summary of Holdbacks (Credit, Liquidity, Mid-Bid, Administrative)</li> <li>Collateral Pledged</li> <li>A number of revenue reports</li> </ul> <p>The risk reports include the following that are generated daily and packaged weekly:</p> <ul style="list-style-type: none"> <li>CDG P/L Plot</li> <li>CDG Plot Report</li> <li>CDG EMG Risk Summary</li> <li>CDG NG Risk Summary</li> <li>CDG Crude Ris Summary</li> <li>CDG Risk Plots</li> </ul> <p>Other risk reports include:</p> <ul style="list-style-type: none"> <li>Market Risk Commentary (weekly)</li> <li>MRC Report (bi-weekly)</li> <li>RMC and RRC Report Packages eight to twelve times annually</li> </ul>		included in the reporting package. BMO should consider adding these reports to the package, presented in a clear manner to provide easy interpretation for management and those not involved with granularities within the book. Also, consolidated P&L reports indicating monthly performance by date should be included.
7.2 - Organization's have user-friendly reports that present risk information in a consistent manner regardless of functional alignment and position level (e.g., Vice President, Director, Manager, Analyst, etc.) to enable sound decision-making	<p>Market risk exposures are reported to the following stakeholders at different frequencies:</p> <ul style="list-style-type: none"> <li>Line of Business</li> <li>Market Risk Committee</li> <li>Balance Sheet Management Committee</li> <li>Risk Management Committee</li> <li>Risk Review Committee of the Board</li> <li>Harris Financial Corp. Board</li> <li>Regulators (OSFI, Federal Reserve, etc.)</li> </ul>		<p>As a result of the current pricing discrepancies the Bank experiences a number of ad hoc reporting tools have been created, mainly to provide support and depth to end-of-month pricing validation.</p> <p>Due to the large volume of reports it is often difficult to discern between which reports are germane to the month-end management reporting package, which reports provide supporting evidence, and which reports are ad hoc reports done on a one-time basis.</p> <p>To clarify the analysis process BMO should consider that these reports be clearly packaged and defined according to role and purpose. Also, it may be prudent for the Bank to consider rolling some of these ad hoc or supporting evidence reports into more frequent reporting packages.</p>
7.3 - Management reports are typically generated and prepared by a control function independent of front office influence (e.g., risk management or risk control)	The monthly management reports are created by the Market Risk, though some P&L explanation and checks for reasonableness are provided by the director and business manager for the Commodity Products group.	✓	Existing practices are consistent with Prevailing Industry Practices
7.4 - Organizations ensure management reporting is independently performed to ensure objectivity and accuracy and to prevent manipulation or fraud.	Management Reporting is primarily performed by Market Risk, with inputs provided by Front and Back Office, eliminating opportunity for one source to manipulate data.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.5 - Organizations provide executive management and the RMC with reports that are generated from read- and write-protected data, time-stamped, and independently certified.	<p>Source data utilized in the creation of risk management reports is ultimately fed from the system of record, MxCom.</p> <p>Transaction data is stored in a secured database accessible only to appropriate personnel and IT.</p>	✓	Existing practices are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<p>7.6 - Types of reports prepared for the RMC, executive and line management vary based on the organization's risk profile. At a minimum, energy companies with commodity transacting operations prepare the following report types:</p> <ul style="list-style-type: none"> <li>Position</li> <li>Financial performance</li> <li>At-risk measures</li> <li>Exposure versus limits</li> <li>Limit compliance</li> <li>Stress testing</li> <li>Credit exposure</li> </ul>	<p>Various financial reports are prepared monthly and distributed to the BMO executive team, such as:</p> <ul style="list-style-type: none"> <li>Balance sheets</li> <li>Income statements</li> <li>Revenue reports</li> </ul> <p>The line of business receives a number of risk reports on a daily basis illustrating various positions, limit exceptions, stress tests and at-risk metrics such as:</p> <ul style="list-style-type: none"> <li>Skew reports</li> <li>Delta reports</li> <li>Slide reports</li> </ul>	✓	Existing practices are consistent with Prevailing Industry Practices.
<b>8. Component: Codes of Conduct</b>			
8.1 - Organizations include formal codes of conduct within Risk Management Policies and Practices.	The Market Risk Corporate Standard serves as the formal code of conduct. It points to specific authority letters governing transacting activities and provides the framework of established policies and practices.	✓	Existing practices are consistent with Prevailing Industry Practices.
8.2 - Organizations require signatures of acceptance from employees.	All signatories having responsibility in the LOB under delegated limits will acknowledge in writing within 30 days from the date that RMC has approved the limits, that they have read and understood the contents of the limit letter.	✓	Existing practices are consistent with Prevailing Industry Practices.
8.3 - All incidents of non-compliance and employee misconduct are to be reported to the RMC.	Incidents of non-compliance are first communicated to the LOB head; however, following that incident all others are reported to the MRC, which then assists on deciding upon subsequent action.	✓	Existing practices are consistent with Prevailing Industry Practices.

## B. Transactional Controls

Transacting processes are a systematic set of operational steps related to transacting in the financial and physical energy markets. These operational steps are collectively referred to as the transactional lifecycle, which begins with the origination of a physical or financial energy transaction and ends with final recording into the firm's accounting books and records.






Corresponding controls must ensure transactional integrity and consistency with the Department's stated risk tolerances and authorized activities. A weak transactional control structure increases the likelihood for a firm to experience undesirable outcomes such as, but not limited to, fraudulent behavior, data corruption, unenforceable contracts, and regulatory investigations (e.g., Department of Energy intervention).







Transaction processing controls include the following control components:

1. Pre-Deal Process
2. Deal Execution
3. Deal Capture and Amendment
4. Deal Entry Validation
5. Contract Administration
6. Confirmations
7. Settlement and Accounting

BMO's current operational processes were assessed relative to each control component, against industry prevalent practices and the corresponding findings and recommendations are presented below.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<b>1. Component: Pre-Deal Processes and Authorization</b>			
1.1 - The pre-deal process consists of the preliminary steps performed by transacting personnel to formulate trading strategies and define action triggers to execute those strategies.	BMO's general trading strategies have not been modified since it began transacting energy derivatives. BMO's transacting process is primarily client driven by the Producer, Consumer and Hedge Fund business and cross-selling within the bank's entities, there is also a recognizable portion of the book attributed to proprietary transactions.  The EMD has daily and weekly trader meeting with the traders and informal meetings during the day when required. During the time Deloitte was in BMO's NYC these daily meetings did not occur. Traders stated daily meetings occurring on ad hoc basis. Attendance includes all traders, EMD Commodity Products and Market Risk (at their discretion). The EMD also holds marketing meetings.	✓	BMO's current practice is consistent with prevailing practices. Daily meetings need to occur at the frequency defined.
1.2 - The pre-deal process typically begins with a planning meeting attended by transacting personnel on a <i>daily or weekly</i> basis	The EMD has daily and weekly trader meeting with the traders and informal meetings during the day when required. Attendance includes all traders, EMD Commodity Products and Market Risk (at their discretion). During the time Deloitte was in BMO's NYC these daily meetings did not occur. Traders stated daily meetings occurring on ad hoc basis. Whenever large deals are considered EMD conducts a specific pre-execution meeting.	✓	BMO's current practice is consistent with prevailing practices. Daily meetings need to occur at the frequency defined
1.3 - Trading strategies and schemes are proposed consistent with the organization's business and operational objectives and senior management's approved and communicated risk	Trading strategies at BMO seek to provide the client base with risk mitigating/transferring instruments through the utilization of the commodities trading desk.	☞	Given BMO's business model of being a market maker in natural gas options to various client segments. The energy hedge funds segment appears to be a substantial participant in the natural gas options market and therefore

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
tolerances.	Trading authorities are established and amended by the Risk Management Committee on an annual basis, though short term extensions can be granted on an as-needed basis following approval from the heads of commodities trading and market risk.		provides meaningful service to BMO's transacting activities. Although hedge fund business is consistent with the Bank's overall risk tolerance, BMO may consider implementing risk weightings by customer segment and related transacting activity to ensure better alignment of market risk exposure of the portfolio with the risk profile of the commodity business.
1.4 – Organizations use the pre-deal process as an opportunity to initiate front office discussions on new trading products and assess the existing infrastructure's capabilities to effectively manage product risks	The EMD has daily and weekly trader meeting with the traders and informal meetings during the day when required. Attendance includes all traders, EMD Commodity Products and Market Risk (at their discretion). During the time Deloitte was in BMO's NYC these daily meetings did not occur. Traders stated daily meetings occurring on ad hoc basis. The EMD also holds marketing meetings.  Whenever there have been large structured deals, we have conducted specific pre-meetings.		BMO's current practice is consistent with prevailing practices. Daily meetings need to occur to the frequency defined
<b>2. Component: Deal Execution</b>			
2.1 - If a deal is executed off-premise (i.e., off the Trading Floor), controls must provide the means to ensure the deal is documented, captured, and confirmed within the organization's existing transacting technology systems and control infrastructure.	Deals transacted 'off the floor' can be executed by several different methods.  First, deals can be executed over the Intercontinental Exchange (ICE), which automatically provides an electronic message indicating execution.  Second, deals transacted using conventional brokers over the phone are communicated to a back-up trader residing on the trade floor, who executes the trade with a broker on behalf of the off-premise trader. At this point a trade blotter is created and the deal is entered in accordance with the standard BMO deal execution and entry process.  Traders are also provided BMO laptops, created for contingency purposes, when transacting off-site.		Existing practices are consistent with Prevailing Industry Practices.
2.2 – Organizations impose policies that limit transacting activities to the organization's "official" place of business.	BMO transacting activities may take place off-site, and those trades conducted on the ICE can occur after normal trading hours.  Trades executed over ICE generate an email message provided to members of Front Office and Market risk		The "Off-Premises" Trading Guidelines should reference individuals or trading personnel authorized to transact off-site. BMO should consider including off-premises wording in the limit letter.
2.3 – Organizations ensure traders/marketers conduct business and make trading decisions in a manner consistent with the organization's existing risk infrastructure. These include compliance with respect to writing deal tickets, checking counterparty creditworthiness and limits, and recording phone conversations.	Each trader creates a deal ticket upon transaction execution. Front Office analysts collect the deal tickets on a periodic basis throughout the day and enter transactions into the system of record, MxCom, a Murex ETRM system.  Credit and market risk limits are assessed at the end of the trading day and communicated to trading personnel before trading activity resumes so any non-compliance issues can be resolved. Traders must conduct business using the turret phones to ensure that conversations are recorded.		Existing practices are consistent with Prevailing Industry Practices.
2.4.1 - Hedging market exposure associated with core business strategies	The core business strategy states that the majority of commodities trading satisfy client driven business. which comes		Existing practices are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	mainly from the Producer, Consumer and hedge fund side. Some of the BMO portfolio is delta-hedged and there is also a large aspect of proprietary trading. Traders utilize a variety of linear instruments and vanilla options as part of the trading activities for Natural Gas.		
2.4.2 – Transacting with approved counterparties and credit limits	Front Office analysts determine if an exception has occurred with respect to counterparty creditworthiness on a daily basis. All exceptions are reported to traders to provide justification and seek approval from the heads of trading, Market Risk, and Back Office to hold the position. Short term limit extensions can be granted for extraordinary positions or situations.		BMO is currently looking at replacing its TCRMS application that calculates counterparty credit risk on a Monte Carlo basis. It is expected that the new system will provide real time counterparty credit checks.  This functionality, along with alerting Trade Capture of counterparty credit exceptions should also prevent deal entry of transactions with unapproved counterparties.
2.4.3 - Working with the Market Risk to ensure that transactions are recorded correctly according to RMC approved methodologies.	Front Office reconciles daily activity at the end of each trading day and ensures that new business has been captured in the system of record, MxCom.		Existing practices are consistent with Prevailing Industry Practices.
2.4.4 - Reviewing position, valuation, market risk and credit risk reports with the Front Office and Market Risk.	Position, valuation, and at risk reports are provided to executive management following review with Market Risk.  Market Risk creates a number of standard reports, including lagged and unlagged positions and slide reports, as well as ad hoc reports to substantiate P&L movements or at the request of Front Office.  To have segregation of duties between traders and marketers and the fact that traders are responsible for managing the position risk, we do not see any benefit of having marketers see the position on a daily basis. In addition, there is a greater chance for an external party to know our position.		Existing practices are consistent with Prevailing Industry Practices.
2.5.1. - Hedging market exposure associated with core business strategies	The core business strategy states that the majority of commodities trading satisfy client driven business, which comes mainly from the producer and consumer side. Some of the BMO portfolio is delta-hedged and there is also a large aspect of proprietary trading. Traders mainly utilize linear instruments as part of the trading activities for Crude Oil.		Existing practices are consistent with Prevailing Industry Practices.
2.5.2 - Working with the Market Risk to ensure that transactions are recorded correctly and valuation and risk measurement are performed according to RMC approved methodologies.	Front Office reconciles daily activity at the end of each trading day and ensures that new business has been captured in the system of record, MxCom.  After discrepancies have been settled Market Risk provides P&L and stress test valuations, as well as a VaR calculation measurement, for each book to the corresponding traders. Traders use their own estimation of the risk in the book to check for reasonableness. The final daily valuations are then communicated to executive management.		Existing practices are consistent with Prevailing Industry Practices.
2.5.3 - Reviewing position, valuation, market risk and credit risk reports with the Director of Physical Natural Gas and the Market Risk.	Position, valuation, and at risk reports are provided to executive management following review with Market Risk.  Market Risk creates a number of standard reports, including lagged and unlagged positions and slide reports, as well as ad		Existing practices are consistent with Prevailing Industry Practices.



Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<p>hoc reports to substantiate P&amp;L movements or at the request of Front Office.</p> <p>Not all books communicate this information to all members of management.</p>		
<b>3. Component: Deal Capture</b>			
3.1 – Organizations align the responsibility of deal capture with the front office.	<p>Front Office analysts collect deal blotters from transacting personnel throughout the day and enter the trades into the system of record.</p> <p>Traders have no direct interaction with the ETRM.</p>	✓	Existing practices are consistent with Prevailing Industry Practices.
3.2 - The front office ensures transaction terms are completely documented and accurately recorded in a <i>centralized</i> trading and risk management system by the close of the business day.	<p>Currently all transactions are entered into MxCom by Front Office, and the deal capture process is scheduled to end at approximately 3:00pm EST.</p> <p>Customization is underway to allow certain exchange traded instruments (ICE) to flow automatically to the system of record.</p> <p>Also, BMO intends to migrate to a new energy transacting platform, OpenLink Endur, in the near future.</p>	✓	Existing practices are consistent with Prevailing Industry Practices.
3.3 - The deal ticket itself is a key control mechanism and prevailing practices include sequential pre-numbering, deal ticket tracking and logging, secured access, and electronic archiving.	<p>Deal ticket templates exist for each trading book, that is commodity and instrument, and capture each transaction sequentially throughout the day. Trade tickets are collected by Front Office analysts, along with marketed transaction tickets, copied and scanned to preserve an electronic copy on the BMO shared drive, which is archived by trading date. Traders do not officially 'sign-off' on deal tickets to approve the entry of transactions into MxCom.</p>	✓	Existing practices are consistent with Prevailing Industry Practices.
3.4 - If deal amendments occur, a formal deal amendment process is clearly established and documented.	<p>All transactions that are modified in MxCom are replace-modified. There is a comprehensive audit trail in the system for all modified tickets in MxCom. The off-system spreadsheet was designed to track errors made by traders or analysts to track performance and to review systemic errors to ensure that operational controls are in place. The official book of record for the Bank is MxCom. If there is a booking error identified by anyone, the Front Office will validate the error to ensure that it agrees with the change, and then will book the change. All stakeholders have the capability of reviewing all replace modified tickets. Tickets that are replace-modified reverse the position and P&amp;L in today's P&amp;L (not historically) and rebooks the new ticket's position and P&amp;L today that have access to the specific folder. At the system level, we restrict read-write versus read only based on who the individuals are. BMO can add additional password protections but believe this would add limited additional controls based on the limited number of users that have access to the specific folder.</p>	✓	Existing practices are consistent with Prevailing Industry Practices.
3.5 - Deal capture practices include Middle or Back Office approval, a system "lock-down" feature for prior business day transactions: and daily	<p>The system is not technically 'locked-down' as traders can conduct business on exchanges after normal business hours. However, trading activity after 3:00pm</p>		See 'Transaction Controls' 3.4 regarding Trade Audit Reports.



Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
audit reports (i.e., Trade Change Report) for monitoring and tracking purposes.	EST will not be entered into MxCom until the following business day. A lock-down mechanism exists to the extent that traders do not have direct interaction with the system at any time. An error report is kept in Excel containing details of all changed transactions, including that discovered the issue, and emailed to the Executive Managing Director of Commodities, the trader, Commodity Business Manager, and Back Office personnel for review.		
3.6 - Off premise transacting is allowed, however procedures and guidelines for conducting off-premise transactions are explicitly documented in the Risk Management Policy. Off-premise transactions, subject to the Company's market, credit and counterparty limits, must be called in, captured on a recorded phone line, and entered into the book of record within 24 hours. A process is in place to ensure that off-premise transactions are entered into the system in a timely and accurate manner.	Off-premise transactions are communicated by the transacting trader to another trader on the desk, who then executes the trade over a recorded phone line, records the trade on a deal blotter for the off-premise trader, and ensures it is entered in to the book by the end of the trading day. At this point, the transaction cycle follows the same deal entry process as other transactions.	✓	Existing practices are consistent with Prevailing Industry Practices.
3.7 - All transactions, without exception, are executed over taped phone lines and are subject to periodic compliance testing by Internal Audit. Recordings are digital and the system is maintained by the IT department. Transactors can access tapes as necessary but do not have authority to delete recordings. The recording system has search capability for archived records in order to facilitate timely retrieval of specific transactions.	All transactions, excluding those transacted over web-based exchange platforms, are executed over recorded phone lines. Recordings are maintained by the IT Voice department and are may be audited by both the Front and Back Offices.	✓	Existing practices are consistent with Prevailing Industry Practices.
3.8 - At a minimum, organizations should retain the past 90 days of taped phone conversations, but this time frame may need to be expanded depending on the volume and term of instruments transacted. Conversations are recorded digitally, are time-stamped, are identifiable by the recording system, and are available for review in real-time. A group independent of the front office should perform periodic checks of system functionality. On a periodic basis, random comparisons are made between the recorded conversations and the terms entered into the system.	The BMO IT Voice department ensures the conversations of all transacting personnel are recorded and maintained. All tapes are stored for a total of 191 days and during that time remain available for auditing purposes and trade dispute resolutions. The Back Office periodically reviews taped conversations in accordance with local regulations and law.	✓	Existing practices are consistent with Prevailing Industry Practices.
<b>4. Component: Deal Entry Validation</b>			
4.1 - Deal entry validation is the end of day "check-out" process to ensure transactions are entered into the transacting systems in a complete, accurate and timely manner. As a prevalent practice, front office deal tickets and transaction summary reports ("Daily Trade Summaries") are independently reconciled by the Middle or Back Office prior to sending confirmations.	Transactions are manually entered by Front Office analysts from blotters at the end of each trading day. Trades are reconciled and verified by traders through the use of data extracts from the system of record. Back Office verbally confirms all deals, including brokered deals unless three-way matching occurs (i.e. MxCom vs. Counterparty vs. Executing Broker). Back Office can view all transactions after the validation process is run.	✓	Existing practices are consistent with Prevailing Industry Practices.
4.2 - Trader/Marketer sign-off is required on "Daily Trade Summaries" to ensure front office accountability.	At the conclusion of each trading day the Bank should consider providing traders an official copy of their respective positions from analysts. These position reports should be initiated by the trader, implying	✓	Existing practices are consistent with Prevailing Industry Practices. The majority of other institutions provide position reports from the system of record.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	agreement between the trader's expected position and the transactions in the system of record.		
4.3 - The Middle or Back Office investigate trade discrepancies with traders directly and resolve immediately.	Back Office reviews each trade on T+1 basis to ensure consistency with the counterparty. If a discrepancy occurs the trader is informed of the dispute and the correct transaction details are determined amongst all parties. Error tracking procedures are in place.	✓	Existing practices are consistent with Prevailing Industry Practices.
4.4 - Trade Tickets/Blotters, Daily Trade Summaries (with sign-off), and exceptions and corresponding resolutions are archived in an organized manner.	All hard copies of trading and marketing tickets are archived, and electronic copies are stored on the shared drive. Daily, the analysts provide the traders with a deal dump and greeks extract from MxCom which is imported to their PRA (in effect the analyst provides the trader a detailed position, by trade which the trader must reconcile and sign off). The trader's reconcile their position and P&L each night. The analysts report the P&L to the back office on a daily basis where the back office reconciles the trader estimate to that of the trader. The head trader signs off the P&L for the group as a whole. Deal exceptions and resolutions are kept in an off-system error log.	✓	Existing practices are consistent with Prevailing Industry Practices.
4.5 – Organizations regularly prepare "audit trail" reports, which enable management to review and validate changes to the "official" book of record on a daily basis.	An off-system error log spreadsheet is maintained and distributed to management as a means to track changes to the book. However, this report is distributed only when a change occurs.	✓	See 'Transaction Controls' 3.4
<b>5. Component: Contract Administration</b>			
5.1 - Front, Middle and Back Office responsibilities are segregated to ensure minimizing violations and maximizing the operational integrity of processing transactions, confirmations and settlements. An independent function initiates, follows-up and manages counterparty confirmations. The Legal department is actively involved in reviewing contract clauses and provisions, particularly for non-standard contracts.	After confirmations have been dispatched to counterparties an independent group within the bank begins a confirmation matching process, which ensures that confirmation details match the details in the system. If a discrepancy should be found or a dispute with the counterparty occurs the issue falls back to Confirmations and Settlements to find the resolution. Typically, this involves communicating with the Front Office to determine the actual trade details, communicating any legal implications with Legal, and any other discrepancy (administrative, etc.) that can be cleared up by Back Office.  Legal must approve all confirmation templates prior to use.	✓	Existing practices are consistent with Prevailing Industry Practices.
5.2 - A designated person, independent of Front Office, obtains and compiles all counterparty information in a centralized database. As counterparty contact information changes, the database is updated in a timely manner.	The Commodities Derivatives Operations group maintains and periodically makes revisions and verifies static data including counterparty and broker information, instruments, and calendar holidays.	✓	Existing practices are consistent with Prevailing Industry Practices.
5.3 - The status of deals in the confirmation process is actively tracked in the book of record. Reports detailing the status of confirmations are generated and reviewed on a daily basis. Confirmations are sent out in a timely manner and are monitored to ensure counterparty receipt, signature and return.	Daily confirmations reports are verified and stored both physically and electronically in the system of record by the Commodities Derivatives Operations group.	✓	Existing practices are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
5.4 - Incoming confirmations are verified against the deal terms in the book of record with minimal manual intervention (i.e. the system has Right fax or email capabilities). For non-standard deals, the transactor reviews the transaction confirmations/contracts. The transactor is familiar with standard templates. Transaction confirmation documents are retained in electronic form (scanned and cataloged) for a time frame in accordance with guidelines established by the Legal department and/or the Risk Management Policy or Market Risk Management Standard.	Approximately 15% of OTC generated confirmations require a customized process. These confirmations are created using MS Word templates and must be sent to the counterparty on a T+2 time frame.  Legal reviews for accuracy and must approve custom confirmation before being sent.	✓	Existing practices are consistent with Prevailing Industry Practices.
5.5 - Confirmation discrepancies are investigated independently of the Front Office and are reconfirmed if necessary. As necessary, subject matter or transaction experts are consulted to resolve discrepancies (e.g., Front Office, Legal, Credit). If necessary, phone tapes are pulled to resolve the dispute. Discrepancies are logged and reported for error-prone individuals and/or counterparties.	When trade discrepancies or a dispute with the counterparty occurs the Commodity Derivatives Operations group initiates an investigation. Typically, this involves communicating with the Front Office to determine the actual trade details, communicating any legal implications with Legal, counterparty considerations with Credit, and any other discrepancy (administrative, etc.) that can be cleared up by Back Office.  Phone tapes are available as a means for dispute resolution. Errors to trade details are tracked.	✓	Existing practices are consistent with Prevailing Industry Practices.
<b>6. Component: Confirmation</b>			
6.1 - Whenever trading transactions are agreed upon, a confirmation is sent to the counterparty as follow up to the verbal trade agreement.	Confirmations are faxed to counterparties for signature on all direct deals (bilaterals). BMO uses the eConfirm service with all participating counterparties, so now confirmations are necessary.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.2 - A confirmation is the official record of the terms of a transaction sent out by each interested party prior to the actual settlement of the transaction itself.	After discrepancies with confirmations have been resolved and signed by counterparties the confirmations are passed to the Matching Group and scanned for record storage.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.3 - The confirmation contains the exact details of the transactions and serves as the legal, practical, and anti-fraud vehicle in the event of contract dispute or counterparty default.	If confirms are issued by BMO, the counterparty will sign out copy, pending agreement, and the contract is sealed. If both parties issue confirms, both copies are matched by the Matching Group. The Legal team is ultimately responsible to ensure that they approve the "template" when dealing with non standard terms. The process cannot proceed without its confirmation.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.4 - Although some companies manually generate confirmations, it is considered prevailing practice to automatically issue a confirmation through the trading and risk management system.	The validation process that pushes transaction data to the Back Office view in MxCom automatically creates confirms and generates tickets simultaneously.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.5 - The Back Office is responsible for initiating, following up, and controlling counterparty confirmations.	Counterparty confirmations are initiated by the Commodity Derivatives Operations group. Confirmation dispute resolution and record-keeping are also performed by Back Office.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.6 - Written outgoing confirmations should be sent to the attention of counterparty's department that is independent of the trading room and require an authorized signature on a	The Commodities Derivatives Operations group maintains static data related to counterparty information within the system of record. Confirmations are automatically faxed to counterparties in accordance with	✓	Existing practices are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
returned confirmation as legal support for contract enforceability.	this information.		
6.7 - Written incoming confirmations are compared in detail with the written outgoing confirmations, and any discrepancies are recorded in a discrepancy log, addressed and resolved within a specified period (this period ranges between one to three business days).	The BMO Matching Group (MG) conducts a thorough comparison to verify transaction information in MxCom to the counterparty's information, or a match from the executing broker.  The Legal team ensures that the template is approved when dealing with non-standard terms.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.8 - It is very important that all discrepancies are followed up, and amended signed confirmations are obtained.	Following the analysis from the Matching Group discrepancies are followed up with respect to brokers, counterparties, Front Office, and Legal.  Confirmations are re-faxed to counterparties for signature and the final copy is stored electronically for OTC trades, or in physical form for OTC cleared trades.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.9 - Amended confirmations reflect all, if any, agreed upon changes in the terms of the transaction.	Amended confirmations are re-sent to counterparties for signature. All changes to the confirmation are then paralleled to the transaction details in the system.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.10 - Organizations have installed telephone-recording systems as a secondary means to resolve trade disputes, discrepancies or errors.	Trader conversations are recorded for each turret phone on the trade floor. This system is maintained and controlled by IT Voice, and each recording is archived for dispute resolution for a period of 191 days.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.11 - When resolving a trade discrepancy or dispute, the tape is reviewed by an independent party along with the trader.	Confirmations and Settlements are authorized to pull required tapes from the IT Voice archive in order to facilitate the resolution of any discrepancy or counterparty dispute.  Conversations are reviewed with the trader when resolving discrepancies.	✓	Existing practices are consistent with Prevailing Industry Practices.
6.12 - Organizations have also included tape archiving rules in their overall document retention standards.	The BMO practice for maintaining and archiving phone conversations is controlled by the IT Voice group, which keeps recordings for 191 days.	✓	Existing practices are consistent with Prevailing Industry Practices.
<b>7. Component: Settlements</b>			
7.1 – Organizations typically require the ability to electronically transfer data from the scheduling system directly into the system of record for transaction settlement.	An extract of the transaction table from MxCom is automatically uploaded to Boost, the settlement processing system at BMO.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.2 - Processes are in place to ensure the consistent uploading of data and manual checks are used to make sure rejected data is investigated and researched in a timely manner.	The Back Office process for validating trades, which automatically pushes the transaction data from the front to the Back Office view.  An independent group performs the Back Office confirmation matching process to ensure the trade details are correct.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.3 - The Back Office monitors payment due dates via manual reports or the system of record.	The system of record, MxCom, provides tracking of settlement due dates, generates invoices, and sends them to counterparties before the settlement date arrives.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.4 - Payment forecasts are prepared and distributed to Treasury for cash management purposes on a daily to weekly basis (depending on the settlement cycle).	The FXMM Operations Group performs on a daily basis a real time, USD cash management and projection for the end of day balance of all BMO units accounts at Wachovia Bank. This includes incoming	✓	Existing practices are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	and outgoing wires generated by the Commodities Group.		
7.5 - Forecasts are prepared manually (e.g., spreadsheet) with data that has been extracted from the Trading System of Record.	Cash projection forecasts for month end balance are created daily.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.6 - On a daily basis, incoming payments are reconciled with outstanding receivables via an automated cash matching process or a manual process that requires data from various sources/systems if the technology is not available.	BMO uses MxCom to automatically perform the cash reconciliation. A report is provided to the Commodities Derivatives Operations group daily for unmatched or outstanding items, which are subsequently investigated.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.7 - Any items that do not reconcile are promptly investigated in accordance to formal reconciliation procedures.	After performing the cash matching process any unreconciled items are investigated daily by Back Office.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.8 - A/R aging schedules are formally prepared and monitored. Reports indicating outstanding receivables (on an aged basis) are distributed to senior and line management on a weekly basis, depending on the volume of transacting activity.	The Margin Account group prepares various aging reports indicating the status of outstanding receivables and provides the status to the line of business management.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.9 - Reserves are established against aged receivables.	The Margin Account group applies reserves to receivables as the likelihood of payment, meaning an aged receivable or high-risk receivable, decreases.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.10 - In accordance with contract language, counterparties may be assessed late charges. Actual assessment of charges may vary due to the nature of the counterparty relationship, but are formally tracked and monitored.	The cash reconciliation and subsequent investigation process informs the Commodities Derivatives Operations group as to which counterparties pay late, and the group advises the line of business as to the findings.  Forms must be completed for the head office in Montreal with respect to assessing late charges. The Montreal office monitors the progress of late payments and tracks the status until it is closed and finalized.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.11 - Settlement discrepancies are handled in a timely fashion, in accordance with established guidelines or written procedures.	A settlements matching process also exists, similar to that of confirmation matching, though it is not performed by the independent Matching Group.  If a discrepancy is found with a settled value the group alerts the client to the dispute and also informs the Front Office.  The Matching Group also produces various aging reports to ensure that discrepancies are addressed expeditiously.	✓	Existing practices are consistent with Prevailing Industry Practices.
7.12 - Any discrepancy in settlement that is more than a routine situation is brought to the attention of the Front Office and a Senior Manager/Supervisor in the Back Office. Further action should be handled and/or directed by management. All discrepancies should be entered into a formal log, which should be reviewed regularly. The log should provide a clear audit trail of the nature of the discrepancy, means of resolution, and final resolution.	For any settlements deemed to be high risk (low probability of payment, excessive age, or large amount) the Margin Account group is notified, as well as the line of business. Clients are contacted regarding payment on a daily basis, but for large amounts greater than several days overdue the risk is elevated to a senior manager level.  The Matching Group also produces various aging reports to ensure that discrepancies are addressed expeditiously.	✓	Existing practices are consistent with Prevailing Industry Practices.



## C. Market Risk Measurement

Market risk measurement combines professional judgment and mechanistic techniques to measure, monitor, control, and report market risk exposures associated with commodity transacting activities. A comprehensive market risk measurement and management program is comprised of policies, processes, controls and systems to mitigate total market risk exposure.




Market risk measurement management is a broad category comprised of the following control components:

1. Market Data Sourcing – Liquid
2. Market Data Sourcing – Illiquid
3. Valuation (Mark-to-Market)
4. Liquidity Reserves
5. Probabilistic Risk Measures
6. Sensitivity Analysis



Deloitte & Touche assessed BMO's current approach for each control component against industry prevalent practices and the corresponding findings and recommendations are presented below.



Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<b>1. Component: Market Data Sourcing Liquid</b>			
1.1 - Leading energy trading firms rely on an automated routine (i.e., manual intervention with the system of record is minimal) to source liquid market data including settlement and forward prices (bid and ask), volatilities and correlations. Typical sources for liquid market data are a combination of automated pricing feeds, trade publications and broker quotes. These sources are clearly documented and approved, through policy, in order to establish a consistent and repeatable valuation and market risk measurement process (i.e., MTM and EaR calculations, respectively)	<p>BMO currently receives the commodity product settlements from Reuters (NG, WTI, HO, BR, etc) and the Metal settlements from Bloomberg.</p> <p>After settlements are published from Reuters and Bloomberg BMO keys them into internal spreadsheets and then uploads those spreadsheets into MxCom. The current system does not support automatic feeds. Therefore, the current BMO process relies on manual entry of key pricing data, particularly at month-end.</p> <p>BMO's current processes include:</p> <p>1) Metals prices are automated from Bloomberg to a spreadsheet that is uploaded into MxCom; 2) Energy Futures Prices are copied directly from Reuters and pasted into an excel spreadsheet that is uploaded into MxCom; 3) Other data is entered into a spreadsheet by each of the respective traders then uploaded into MxCom. BMO compensating controls include: 1) all futures prices are checked daily by the Back Office; 2) Futures price discrepancies would be detected the following day when calculating the exchange margin calls 3) forward prices and implied volatilities are checked twice per month to independent prices received by the Back Office.</p>		<p>The current end of month process calls for Front Office personnel to manually update pricing spreadsheets for several books.</p> <p>BMO should consider formally automating the price aggregation process for uploading official data sources. Vendors that provide tools to aggregate data are LIM, KiodeX, etc. Automating the price aggregation reduces potential administrative risks associated with manual forward curve manipulation and construction. BMO will still be required to independently verify prices to specific thresholds prior to uploading prices into the system of record.</p> <p>Formal price and volatility verification procedures should be reviewed and approved by the Risk Management Committee.</p>
1.2 - Risk Management (i.e., Market Risk) is accountable for ensuring market data is reasonable and should have the authority to challenge Front Office market data, as necessary.	Valuation Product Control is accountable for performing the Independent Price Verification process, communicating results and recommendations for valuation adjustments to all stakeholders, and obtaining sign off from financial front office and the EMD level of Market Risk on a monthly basis. Authority is outlined in the Independent Price / Rate Verification and Review May 2006 documentation.		Existing practices are consistent with Prevailing Industry Practices.











Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<p>1.3 - Formal liquid market data sourcing standards should be developed and documented. Documentation should identify the following, at a minimum:</p> <ul style="list-style-type: none"> <li>Authorized market data sources;</li> <li>Sourcing methodology;</li> <li>Roles and responsibilities;</li> <li>Model approval and validation requirements;</li> <li>Delegated authority for approving exceptions; and</li> <li>Frequency of independent validation.</li> </ul>	<p>Forward curve (price and volatility) construction is performed by the Front Office. BMO's Independent Price / Rate Verification and Review May 2006 ("IPV") establishes roles and responsibilities for price verification procedures, including frequency of price verification procedures and process for approving changes as a result of identified exceptions. Documentation addresses thresholds for investigation or adjustment and states that "thresholds can be applied at trade/position level as well as individual desk level, as a dollar amount...tolerance levels can also be by volatility measurement as with option products." IPV documentation references BMO Commodity Derivatives Group Official Rate Source Document and Price Verification Policy ("ORSD") for authorized sources of market data.</p> <p>ORSD identifies various approved sources of independent price data for mark-to-market portfolios. Data sources identified include NYMEX settled prices and London Metals Exchange (LME) futures settled prices. Authorized sources used by Market Risk in the IPV process for validating trader marks, such as brokers and price consensus reports, are not identified in the ORSD.</p>		<p>IPV and ORSD documentation should be enhanced to include approved market data sources for each authorized trade activity or location. To a certain extent, this exists in Appendix 1 – Source and Variance Tolerance Grid of the Official Rate Source Document. However, only one broker, Optionable, is listed for Gulf Coast, Mid Continent, and West Coast options and swaptions. The document should reference at least two additional independent pricing sources for each instrument and pricing location.</p> <p>The documentation should include identification of specific sources of independent data, a hierarchy of reliability of each source, and the method used to aggregate the sources that will be used (average of the source data, weighted average of the data based on reliability or relevance, etc).</p>
<p>1.4 - Risk Management should rely on multiple broker option quotes, whenever available, to determine <i>implied</i> volatilities.</p>	<p>Market Risk obtains option price and volatilities from price consensus sources and broker option quotes for independent price verification purposes.</p>		<p>Existing practices are consistent with Prevailing Industry Practices.</p>
<b>2. Component: Market Data Sourcing Illiquid</b>			
<p>2.1 - The Market Risk (Market Risk Management) either validates all illiquid curves developed by the front office, on a regular basis (at least monthly and more often as dictated by market conditions), or source the illiquid market data itself, using procedures approved by a Risk Management Committee. The Market Risk procedures are then periodically reviewed (at least quarterly, or more often if market conditions change) by an independent function (e.g., Internal Audit, third-party industry specialist, etc.). This ensures that forward curves are built and validated using consistent methods, and provide a sound framework for financial reporting.</p>	<p>Market Risk determines price sources in conjunction with Front Office as documented by the ORSD. The majority of prices are independently provided to the back office based on the ORSD. Recently, for specific quotes including illiquid quotes relating to options BMO has begun to collect both consensus market data and third party broker quotes to independently verify and calculate the natural gas portfolio's valuation and corresponding reserves.</p> <p>Market Risk view differs on one point and that is it is required to contact the Front Office before requesting quotes from brokers for the specific pricing relating to options. Detail follows on differing views:</p> <p><b>Market Risk View Point:</b></p> <p>Market data is currently collected by Front Office personnel utilizing either broker quotes received from instant messages or over the phone/shout down boxes.</p> <p>Market Risk is required to contact the front office before request pricing information directly from a broker, who then obtains the data from the broker and relays the broke quote to Market Risk.</p> <p><b>Front Office View Point:</b></p> <p>There are various data sources that are provided independently to the back office at month-end to complete their price verification process. Pipeline swaps</p>		<p>BMO should include context in the IPV and Official Rate Source Document stipulating Market Risk's independence with respect to the collection of market data. Independence can be defined in the following manner: 1. The Market Risk independent of the front office contacts brokers for pricing information and determines the value for pricing inputs; 2.</p> <p>The Market Risk provides requested pricing points to the front office and watches/audits the collection of requested quotes from brokers. In addition, the Market Risk determines the final value for pricing. This type of process was put in place during the Deloitte engagement at the end of February 2007.</p> <p>This ensures integrity of the market data gathered. Market risk has the final decision as to determination of value for a pricing point and always obtains the right to contact brokers independently of the front office.</p>









Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<p>brokers are: 1) TFS; 2) ICAP; 3) Amerex; and 4) GFI. Option brokers are: 5) Manfinancial; 6) Optionable; 7) Spectron; 8) TFS; 9) Prebon; 10) Choice; and 11) United.</p> <p>Market Risk and the Front Office agreed that if Market Risk needed additional quotes at anytime during the month, that Market Risk staff get on the phone with the trader, or that the trader send an IM to a relevant broker in Market Risk's presence. In addition, Market Risk independently at the end of each month sends an options grid directly to Optionable and the grid comes back directly to Market Risk. Furthermore, Market Risk can also request ad-hoc quotes from Optionable independently, without the traders knowledge, during the month.</p> <p>In addition to all of the above, it was agreed that Market Risk will provide the traders requests for quotes and the traders will provide Market Risk the relevant IM's in Market Risk's presence.</p> <p>There was a concern that Market Risk may inadvertently advise the broker of our position, therefore, both the Front Office and Market Risk agreed to the process where the trader would assist Market Risk in obtaining the information that they requested.</p>		
<p><i>FAS 157 Considerations</i></p> <p>FAS 157 <i>Fair Value Measurements</i>, effective for financial statements issued for fiscal years beginning after November 15, 2007, and interim periods within those fiscal years, introduces the concept of an "exit" price in determining fair value. Fair value should be measured based on "the price that would be received to sell the asset or paid to transfer the liability at the measurement date" (FAS 157 paragraph 7). FAS 157 requires the use of observable market data inputs to the extent available. Observable and unobservable inputs are defined by FAS 157 paragraph 21 as follows:</p> <ul style="list-style-type: none"> <li>• <i>Observable inputs</i> are inputs that reflect the assumptions market participants would use in pricing the asset or liability developed based on market data obtained from sources independent of the reporting entity.</li> <li>• <i>Unobservable inputs</i> are inputs that reflect the reporting entity's own assumptions about the assumptions market participants would use in pricing the asset or liability developed based on the best information available in the circumstances.</li> </ul> <p>Quoted prices in an actively traded market would be considered the most relevant source of data. In a less active market, quoted prices are less reliable. Volume and level of activity in the market should be considered when determining whether quoted prices represent a fair value measurement.</p>			
2.2 - Authorized forward trading activity related to illiquid trading points should be developed with clearly defined parameters. Transacting constraints for illiquid locations should be explicitly expressed in a "List of Authorized Products" and can be further controlled through a <i>qualitative risk limit structure</i> .	Market Authority Letters, prepared by the Executive Managing Director of the Commodity Derivatives group, are sent to each trader, establishing limits for lagged greeks and positions, tenor, and concentration. The Market Authority Letter also identifies approved products. Market Risk Corporate Standard (October 2006) states that trading activity outside the approved list is subject to the IBG New Products Approval Process and Immediate Approval Process. Approval must be obtained from the relevant Co-President, BMO Capital Markets or his/her delegate and from Market Risk Oversight through the Immediate Approval Process, prior to execution and additional approval is obtained from other key stakeholders in the New Products Approval Process.		Existing practices are consistent with Prevailing Industry Practices.
2.3 - Formal illiquid market data sourcing standards should be developed and documented in a manner similar to liquid market data sourcing standards	Forward curve construction is performed in the Front Office and independently validated by Market Risk through the Independent Price Verification (IPV) Process.		IPV and ORSD should include identification of specific sources of independent data, a hierarchy of reliability of each source, and the method used to aggregate the sources that will be used (average of the source data, weighted average of the data based on reliability or

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
			relevance, etc).
2.4 – Integrity of Market Data Collection	<p>Market Risk determines price sources in conjunction with Front Office as documented by the ORSD. The majority of prices are independently provided to the back office based on the ORSD. Recently, for specific quotes relating to options BMO has begun to collect both consensus market data and third party broker quotes to independently verify and calculate the natural gas portfolio's valuation and corresponding reserves.</p> <p>Market Risk view differs on one point and that is it is required to contact the Front Office before requesting quotes from brokers for the specific pricing relating to options. Detail follows on differing views:</p> <p><b>Market Risk View Point:</b></p> <p>Market data is currently collected by Front Office personnel utilizing either broker quotes received from instant messages or over the phone/shout down boxes.</p> <p>Market Risk is required to contact the front office before request pricing information directly from a broker, who then obtains the data from the broker and relays the broke quote to Market Risk.</p> <p><b>Front Office View Point:</b></p> <p>There are various data sources that are provided independently to the back office at month-end to complete their price verification process. Pipeline swaps brokers are: 1) TFS; 2) ICAP; 3) Amerex; and 4) GFI. Option brokers are: 5) Manfinancial; 6) Optionable; 7) Spectron; 8) TFS; 9) Prebon; 10) Choice; and 11) United.</p> <p>Market Risk and the Front Office agreed that if Market Risk needed additional quotes at anytime during the month, that Market Risk staff get on the phone with the trader, or that the trader send an IM to a relevant broker in Market Risk's presence. In addition, Market Risk independently at the end of each month sends an options grid directly to Optionable and the grid comes back directly to Market Risk. Furthermore, Market Risk can also request ad-hoc quotes from Optionable independently, without the traders knowledge, during the month.</p> <p>In addition to all of the above, it was agreed that Market Risk will provide the traders requests for quotes and the traders will provide Market Risk the relevant IM's in Market Risk's presence.</p> <p>There was a concern that Market Risk may inadvertently advise the broker of our position, therefore, both the Front Office and Market Risk agreed to the process where the trader would assist Market Risk in obtaining the information that they requested.</p>		<p>BMO should include context in the IPV and Official Rate Source Document stipulating Market Risk's independence with respect to the collection of market data. Independence can be defined in the following manner: 1. The Market Risk independent of the front office contacts brokers for pricing information and determines the value for pricing inputs; 2. The Market Risk provides requested pricing points to the front office and watches/audits the collection of requested quotes from brokers. In addition, the Market Risk determines the final value for pricing. This type of process was put in place during the Deloitte engagement at the end of February 2007.</p> <p>This ensures integrity of the market data gathered. Market risk has the final decision as to determination of value for a pricing point and always obtains the right to contact brokers independently of the front office.</p>
<b>3. Component: Valuation - Mark-to-Market (MtM)</b>			
3.1 - MtM transactions and portfolios daily to facilitate monitoring changes in their value due to changes in forward	BMO initially marks its transactions and portfolios using forward curves provided by the front office.		Existing practices are consistent with Prevailing Industry Practices.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
market curves. MtM is the present value of a transaction.	by the front office.		
<p>3.2 - The middle office should validate the market data inputs provided by the front office. The middle office should perform this validation of the forward curve data using sources independent of the transacting function to the extent possible to eliminate any front office influence.</p> <p>This should include a comparison of forward marks provided by the front office with at least 2 external sources of data such as brokers, ICE and Totem.</p> <p>ICE and Totem are generally utilized as benchmarks for the reliability of broker quotes. If broker quotes are outside of ICE and Totem bid/offers institutions will mark directly to ICE and/or Totem or develop a weighted average price of quotes and ICE and Totem.</p>	<p>BMO previously used a single broker, Optionable (OPEX, Orion) for marking the natural gas NYMEX look-alike options transactions to market.</p> <p>Market Risk has since obtained additional market indications including consensus estimates at month end from Totem and data from ICE as well as additional broker quotations. This collection of broker quotes is done by the front office.</p>		<p>BMO should use at least two external sources of data to validate the front office marks. To the extent these external sources deviate from the front office marks reserves should be considered and these are discussed in Section 4 of this table.</p> <p>ICE and Totem are generally utilized as benchmarks for the reliability of broker quotes. If broker quotes are outside of ICE and Totem bid/offers institutions will mark directly to ICE and/or Totem or develop a weighted average price of quotes and ICE and Totem.</p> <p><i>Note: FAS157 considerations from previous page.</i></p>
3.3 - The models used for valuing the transactions should be validated by the middle office. This would include reviewing the assumptions underlying the model for appropriateness and/or consistency with standard industry practice. Furthermore, the middle-office should ensure that commercial and proprietary pricing models and MtM methodologies are correctly implemented.	BMO's vetting group has vetted the pricing and skew models.		Existing practices are consistent with Prevailing Industry Practices.
3.3.1 - With respect to simple NYMEX look alike European options on natural gas, practitioners typically use a Black type option model for valuation.	<p>BMO's natural gas options consists of approximately 90% NYMEX look alike options that are European.</p> <p>BMO uses an Asian model with a single day averaging period to value its European NYMEX look-alike options on natural gas.</p>		<p>The use of a Black type model to value European NYMEX look-alike natural gas options is consistent with Prevailing Industry Practices.</p> <p>We validated the European model outputs using BMO's inputs for a small sample of their natural gas European option transactions with an independent model. The results were consistent with the Black model used for such instruments.</p>
3.3.2 - Volatility surface calculation within natural gas markets is migrating towards the application of a stochastic volatility model to fit option volatility skew surface.	Both the BMO Front and Market Risk personnel informed us that the skew model being applied is the Omega Model within PRA. The Omega Model is essentially a quadratic fit with three parameters: "boost", "skew" and "wings" that are calibrated. This same skew model has been implemented within MxCom. The vetting group does a periodic review of the choice of the skew model to ensure correct application and use by commodity asset class.		<p>Based on our experience, there are other organizations using polynomial techniques to fit option skew for vanilla options. However, these same organizations realize there are potential issues with the quadratic (polynomial) fit approach.</p> <ol style="list-style-type: none"> <li>1. The inability to fit many observations for the skew due to the small number of degrees of freedom in a quadratic function.</li> <li>2. The calibration of the model for exotic options. Since we were told that the portion of the natural gas options book that was not European vanilla options was very small this may not be a major issue.</li> </ol> <p><i>Note: Volatility skew surface modeling is a fairly dynamic process and is continually being refined by leading energy market participants. With this said, there are varying practices related to creating the volatility surface for natural gas options among firms. However, prevailing practice seems to be migrating toward the use of more sophisticated stochastic processes than geometric Brownian motion to better fit the prices of plain vanilla and exotic options such as the application of a stochastic volatility model. To the extent the portfolio is comprised of primarily plain vanilla options and</i></p>

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
			market quotes are available simpler volatility surface calculations are acceptable.
3.4 - The middle office should ensure transactions are decomposed and modeled in the "official" energy transacting and risk management system. Once all transaction components are identified, the middle office should ensure appropriate models have been selected based on the transaction's component's structure.	BMO's natural gas options book is comprised of standard vanilla natural gas exchange traded or OTC options. They essentially do not have to do any decomposition with their current traded products.		Existing practices are consistent with Prevailing Industry Practices.
3.5 - All pricing models that require calibration should be subject to regularly scheduled calibration. The middle office should ensure the calibration of the model parameters is completed as defined.	<p>The front office generally recalibrates the skew at the end of the month and additionally at non-fixed intervals. If a perceived change in the market is confirmed over successive days, then the skew will be recalibrated by the front office intramonth. The skew calibration process is as follows:</p> <ol style="list-style-type: none"> <li>1) Obtain the straddle's market quotes</li> <li>2) Input the ATM implied volatilities from Step 1 in the Skew Calibration spreadsheet</li> <li>3) Set the strikes equal to the price at one standard deviation (1-SD) on both sides of the current underlying calculated in the Skew Calibration spreadsheet</li> <li>4) Obtain the market quotes from the OTM options at the 1-SD strike and derive the OTM implied volatility (IV) at the 1-SD strike</li> <li>5) Calculate the "vol diff" (difference between OTM IV above and ATM IV)</li> <li>6) Use the Fit_Skew_Vb function to derive Skew, Wings, and Boost values by using "vol diff" and other required inputs for Fit_Skew_Vb function</li> <li>7) Adjust the Boost value (without changing Skew and Wings from step 6) such that the volatility curve "best fits" other than the 1-SD implied volatility such that implied volatilities at those other strikes would lie within the Bid-Ask spreads of the quotes.</li> </ol> <p>The skew calibration results are checked by the middle office via their relationship to market data at month end.</p>		<p>BMO should consider establishing formal protocols for skew recalibration for both the front office as well as middle office verification.</p> <p>For instance, BMO should consider defining and implementing certain market criteria, defining frequency, and providing explanations for skew calibration.</p>
	The Vetting Group last reviewed the calibration of the skew model in 2001.		BMO should consider vetting the calibration process whenever changes are made to the model.
<b>4. Component: Close-out and Liquidity Reserves</b>			
4.1 - Liquidity reserve calculations should apply one-half of the bid/ask spread to (the absolute value of) all net delta and vega positions in a discrete commodity, time period and delivery area. This effectively results in marking net longs to bid prices and net shorts to ask prices.	<p>Valuation Product Control calculates a close-out adjustment by applying a mid / bid factor to the open delta and vega NYMEX (or OTC with same underlying) positions aggregated by maturity period (bucketed by seasonal and calendar strips). The mid / bid factor was determined several years ago based on the historic mid / bid spread, and has not since been updated.</p> <p>Additional reserves are recorded for fixed price exposure and pipeline (basis) exposure. Calculation of the close-out adjustment for fixed price and pipeline risk is calculated in a manner consistent with</p>		<p>Close-out charges should be periodically reviewed to ensure the adjustment reflects the market observed mid / bid spread. Additionally, prevailing practice would suggest the use of unlagged delta and vega positions should be used in the close-out reserves calculation. The bid / ask spread is expected to increase as liquidity decreases, resulting in a more significant reserve on positions further from the ATM strikes and long dated positions.</p> <p>Note: Explicitly we have not observed any market participants that calculate lagged delta or vega calculation for liquidity reserve purposes and the majority of firms utilize unlagged delta or vega calculation for liquidity reserve purposes.</p>

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<p>the close-out adjustment described above. Specific reserve adjustments may also be taken to account for other market data uncertainties.</p> <p>Open delta and vega positions used in the close-out reserve calculations described above are "lagged". Lagged delta is measured as the number of equivalent front month contracts' delta and vega when a given volatility ratio relative to the front month contract is applied. Lagged Vega is measured as the net dollar amount of equivalent front month contract vega when a given implied volatility ratio relative to the front month contract is applied to each contract vega position. Lag factors are maintained by the Front Office and reviewed periodically by Market Risk. Risk Reporting extracts the lagged position report from the PRA system and forwards to VPC for the close-out reserve calculation.</p>		
4.2 - An additional liquidity adjustment be taken when a sizable net position, if flattened, would result in price curve movements outside the bid/ask spread	Valuation Reserves and Adjustments for Mark-to-Market Trading Portfolios June 2006 documentation establishes procedures for recording liquidity reserves for positions exceeding the perceived upper bounds of market liquidity. The liquidity reserve is intended to capture costs not reflected in the close-out reserve. There are currently no liquidity reserves taken for commodity positions.		BMO should consider evaluating current positions relative to market trade activity to determine whether additional liquidity reserves are necessary. The close-out and liquidity factors should be reviewed and updated on a quarterly basis based on market liquidity and significance of portfolio positions.
4.3 – Specific analytics be employed to ensure positions within each bucket demonstrate similar liquidity characteristics (e.g., same bid/ask spreads, similar basis differentials, and high correlations of spread movements to each other).	<p>Positions are bucketed by season in the front months and by calendar strip in the back end. There are no analytics performed; however, bucketing is consistent with observed trade activity and standard broker quotes.</p> <p>For instance, bucketing is aggregated /netted by delta based upon the underlying commodity, strike, and tenor. Aggregated/netted delta positions are aggregated by tenor points consisting of by calendar year. Firms then decide how to bucket the calendar years for liquidity adjustments consistent observed trade activity and standard broker quotes.</p>		Existing practices are consistent with Prevailing Industry Practices. Specific to industry practice imply practicality to bucketing based upon how transactions are transacted.
4.4 - A close-out adjustment methodology, including position bucketing and illiquid spread development assumptions and supporting analytics, should be documented by the Market Risk and reviewed and amended (as needed) by the RMC on a regular basis (at least quarterly and more frequently if market conditions change)	<p>Commodity Derivatives Closeout and Liquidity Reserves Calculation Methodology (December 8, 2005) documentation addresses the close-out reserve methodology, calculation of the delta close-out reserve, calculation of the vega close-out reserve, frequency of close-out reserve calculation, and approval of close-out reserves and valuation adjustments. Documentation was drafted by Valuation Product Control</p> <ul style="list-style-type: none"> <li>The documentation has been distributed to various individuals in Market Risk, Market Risk Oversight and the Commodities Derivatives Group. Documentation states that close-out charge represents half the assessed bid/offer spread for the delta and vega; however, in practice, the charge was established some time ago (at least 2 years) and has not since been updated.</li> </ul>		Documented methodology and procedures are consistent with industry practice; however, BMO should consider periodically reviewing the close-out factor and updating it in accordance with policy and standards to ensure the market conditions and observed mid / bid spreads are reflected in the adjustment.

Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<p><i>FAS 157 Considerations</i></p> <p>FAS 157 paragraph 31 addresses the bid-ask spread and states that the point within the spread that most represents fair value should be used. Therefore, the bid price would likely be used for long positions and the ask price likely used for short positions. The Board also emphasized consistency in application. FAS 157 paragraph C91 states, in part:</p> <p style="padding-left: 40px;">The Board decided that the price within the bid-ask spread that is most representative of fair value in the circumstances should be used to measure the fair value of the related asset or liability within all levels of the fair value hierarchy, <b>provided that the price is consistently determined.</b> [Emphasis added]</p> <p>The bid-ask pricing method should not be changed without establishing that a change in method will result in a measurement that is equally or more representative of fair value.</p> <p>In addition, while a different point within the bid-ask spread may be used for different assets and liabilities (consistent with the guidance in paragraph 31), the same bid-ask pricing convention should be used for similar assets and liabilities unless the use of a different point within the bid-ask spread for such items can be supported.</p>			
<b>5. Component: Value-at-Risk Measures</b>			
<p><b>5.1 - Inputs – Data Feed</b></p> <p>Inputs used for VaR calculation are consistent with those required for other purpose throughout the institution.</p>	<ul style="list-style-type: none"> <li>Greek values for Delta-Gamma-Vega approximation for the portfolio change valuation are not direct feeds from BMO's system of record (MxCom). Some Greeks from MxCom are modified before being input into the NVaR system. For example, the spurious Gamma for the options close to the expiry is filtered out or modified before being input into the NVaR system. The NVaR system neither calculates nor validates those Greeks.</li> </ul>		BMO should consider having documentation of approved methodology and procedures for modification of data feed from MxCom to the NVaR system.
<p><b>5.2 - Inputs – Seasonality</b></p> <p>Inputs are used and/or calibrated such that pertinent characteristics and features (i.e. seasonality, correlation, and volatility) are reflected in the risk factors.</p> <p>As the constant maturity term structure widely used for capturing risk factors of fixed income instruments does not account for the seasonality of the commodity business, institutions adopt the calendar-month or constant-promptness technique to capture the seasonality of the commodity term structure.</p> <p>The calendar-month technique treats each delivery contract as an individual contract whose risk factors (i.e., prices, implied volatilities) are unique to it. For example, the risk factors of Nov-07 contract are only derived from the price and implied volatility data of the Nov-07 contract only not from the Nov-06, Nov-05, Nov-04 and so on.</p> <p>The constant promptness technique takes into account what month of year the contract delivery is as well as how far out the contract expiry is (the contract's promptness). For example, the Nov-07 and Dec-07 contracts as of September 1, 2007 will be represented the same way as the Nov-06 and Dec-06 contracts as of September 1, 2006. Due to its similarity to the constant-maturity technique, the constant-prompt technique seems to gain more popularity among financial institutions and energy trading companies.</p>	<ul style="list-style-type: none"> <li>The annualized average volatilities and correlations for price returns and implied volatilities are currently used as risk factor inputs in the VaR calculation. Such inputs discard the prevailing seasonality effect of commodity markets such as natural gas.</li> <li>Therefore, Market Risk has developed a technique to incorporate seasonality into the volatility and correlation inputs. With the implementation of such technique, delivery months will be treated as individual months for the first 36 months and grouped into 6-month buckets thereafter for 2 years. Twelve (12) 36x36 covariance correction factor matrices will be constructed and calibrated to transform the annualized average volatilities and correlations of the generic months' risk factors, which are currently computed based on one year of historical data, into seasonally-adjusted values. Each transformation matrix is based on four years of data which yield about 88 data points (4 years times 22 trading days) for a given calendar month. All 12 transformation matrices are calibrated quarterly.</li> </ul>		Current practice is not consistent with Prevailing Industry Practices; however, the proposed approach is consistent.
<p><b>5.3 - Inputs – Bucketing</b></p> <p>The granularity of tenor buckets needs to take into account the seasonality effect and characteristics of traded</p>	<ul style="list-style-type: none"> <li>Upon the implementation of the proposed VaR calculation for commodity portfolios, positions for the first 36 months will be assigned to the correct buckets. Contract month 37 –</li> </ul>		Current practice is not consistent with Prevailing Industry Practices; however, the proposed approach is consistent.



Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
<p>products of commodity of interest. For natural gas, the winter months (Nov-Mar) and shoulder months (Apr-Oct) are normally traded as strips and therefore should be bucketed accordingly. The front end of the curve (2 years out) is quite liquid in which contracts can be quoted monthly. Most institutions have monthly buckets for at least 2 years out and then seasonal, semiannual, and annual buckets thereafter.</p> <p>The physical positions and/or daily-index settled transactions which expose the institutions to intra-month price risk are grouped into the relevant Day-Ahead, Balance-of-the-Week, and Balance-of-the-Month buckets.</p>	<p>correct buckets. Contract month 37 – 60 will be grouped into designated semi-annual buckets.</p> <ul style="list-style-type: none"> <li>Positions that have expiry dates beyond 5 years will be grouped into the month-60 semi-annual bucket. Consequently, those longer-dated positions will use the same risk factors derived for the month-60 delivery contract.</li> </ul>		
<p>5.4 - Inputs – Contract Rollover</p> <p>Institutions and energy firms apply contract rollover technique to smooth out the time-series data of the risk factors (i.e. price returns, implied volatilities).</p> <p>Varying from one firm to another, the rollover period typically ranges between 3-6 days before the expiry.</p>	<ul style="list-style-type: none"> <li>In order to minimize the effect of significant increases of implied volatility of the prompt-month contract close to the expiry date, Market Risk is currently applying 3-day rollover window to the time-series data.</li> <li>After having recently analysed data using 3, 5, 6, and 7-day rollover windows, Market Risk concluded that the current 3-day rollover window still tends to overestimate the volatility of the prompt-month contract approaching the expiry day. Therefore, the proposed NVaR system will use a 6-day rollover window by using the volatility of Month-2 (month after the prompt month) contract during 6 trading days before the expiry of each calendar month.</li> </ul>	✓	Existing practices are consistent with Prevailing Industry Practices.
<p>5.5 - Methodology</p> <p>Historical or Monte Carlo simulation VaR is calculated on all instruments and portfolios on a daily basis. A full valuation approach (e.g. Monte Carlo) is recommended when measuring the risk of complex portfolios with a high degree of optionality. Institutions using Monte Carlo simulation also apply stochastic variance techniques attempting to capture fat-tails for portfolios' return distributions.</p> <p>Most institutions simulate change of ATM implied volatility and assume a parallel shift to the implied volatility curve across all strikes.</p>	<ul style="list-style-type: none"> <li>BMO's NVaR is a "partial" revaluation Monte Carlo simulation based VaR system. The partial revaluation is based on the Delta-Gamma-Vega (DGV) approximations.</li> <li>In order to factor in the "fat-tail" effect of the portfolio return distribution, the NVaR Monte Carlo simulation engine utilizes Multivariate Generalized Stochastic Variance (DGV) with Gamma-distributed variables to generate 20,000 outcomes.</li> <li>For implied volatility risk factors, NVaR simulates ATM volatility and assumes a parallel shift to a respective volatility curve. Hence, the shape of the volatility curve (i.e. curvature and skewness) is assumed to remain the same for all iterations.</li> </ul>	✓	Existing practices are consistent with Prevailing Industry Practices.
<p>5.6 - Outputs</p> <p>VaR system capabilities are present allowing for VaR to be aggregated ('rolled up') across, and drilled down into, different products and lines of business. The VaR system has the ability to calculate VaR for sub-portfolios, commodities and traders.</p> <p>VaR outputs are stored and maintained in the VaR system or designated database by the Market Risk with authorized access.</p>	<ul style="list-style-type: none"> <li>The current NVaR system, on a (business) daily basis, produces an aggregate VaR for the Commodity Derivatives Group ("CDG") as well as ones at the book level (i.e. AECO, NYMEX Fixed-Price, Options, etc.). Only the \$8M VaR limit is imposed at the aggregate CDG level. There are no desk-level VaR limits. In addition to VaR, the NVaR system is also capable of producing the following outputs for each respective portfolio: <ul style="list-style-type: none"> <li>Expected shortfall</li> <li>All 4 moments of distribution</li> <li>Backtest results</li> </ul> </li> </ul>	✓	Existing practices are consistent with Prevailing Industry Practices.



Prevalent Industry Practice	BMO's Current Practice	Rating	Recommendation
	<ul style="list-style-type: none"> <li>On each business, VaR is produced and gathered by the Market Risk VaR Group. The results are sent to select members of Market Risk for an internal review. The EMD of Market Risk approves the release of VaR numbers for reporting. The approved VaR then is input into "JUICE" database for official records.</li> </ul>		
<p>5.7 - Backtesting</p> <p>Most institutions perform backtesting of One-Day VaR versus Theoretical Daily P&amp;L of the same portfolio composition (from the prior day) based on at least one year of data.</p> <p>For small sample settings, some leading institutions conduct additional statistical tests using historical performance data to assess the robustness of the VaR methodology.</p>	<ul style="list-style-type: none"> <li>The historical actual one-day return is compared to the computed VaR of each portfolio to perform a backtest of VaR.</li> <li>Market Risk indicated that the backtest results over the past trading year for the CDG were in the "green zone" and acceptable according to the Basel guideline.</li> </ul>	✓	Existing practices are consistent with Prevailing Industry Practices.
5.8 – VaR Model Testing Approach	<ul style="list-style-type: none"> <li>Following methodology changes related to risk bucketing, seasonality, and changing the rollover window to the VaR calculation the Bank intends to test and verify the enhancements in parallel with the old methodology for six non-consecutive days.</li> </ul>	👉	BMO should consider lengthening its testing phase after making adjustments to the NVaR system. The six days non-consecutive approach is acceptable but does not meet prevailing industry practices for risk model testing. Prevailing testing practice constitutes 30 consecutive business days over 2 roll periods (standard minimum practice). This allows for a broader perspective to capture more types of transactions or changes in portfolio composition.
<b>6. Component: Stress Testing</b>			
<p>6.1 – Stress Testing</p> <p>Institutions rely more heavily on stress tests for extreme, but plausible, events and for risk factors whose risks may be inadequately captured by their implemented VaR measures. Stress tests can be based on significant historical market events updated to current conditions. Examples include natural gas and pipeline price spikes in February 2003 and those caused by hurricane Katrina.</p> <p>"Compound" scenarios that take into account risk profiles of portfolios and the possibility of simultaneous changes in all relevant risk factors are applied.</p>	<ul style="list-style-type: none"> <li>BMO imposes the \$45M stress test limit at the aggregate CDG level. The stress tests are based on probabilistic scenarios at the 99.95% confidence level (6.5 sigma) and a full revaluation of the portfolios.</li> <li>Currently, there are certain "compound" scenarios (i.e. price curve shifts plus curve twist plus volatility shifts) which have far less likelihood than the 0.05% chance required by the bank's stress testing due to the fact that the compound scenarios were constructed based on combining several "single" stress scenarios (6.5-sigma events). Market Risk is aware of the challenge and in the process of coming up with new compound stress scenarios.</li> </ul>	👉	As a large portion of the bank's commodity market risk exposure is attributed to the NG option book, BMO should consider applying shocks to the skewness of the volatility curves.

**APPENDIX 1: INTERVIEW LIST**

The following is a list of BMO and third-party individuals interviewed as part of the Commodity Risk Measurement, Valuation and Control Infrastructure Assessment.

	<b>Name</b>	<b>Title</b>	<b>Initial Interview Date</b>
1	Eric Tripp	Co-President, BMO Capital Markets	20 February 2007
2	Danny Costa	Managing Director, Trading Products, Risk & New Initiatives	20 February 2007
3	Murray McIntosh	Managing Director, Market Risk	20 February 2007
4	James Hughes	Managing Director, Risk Models & Infrastructure	20 February 2007
5	Penny Somerville	Executive VP and Senior Market Risk Officer	20 February 2007
6	Bob Moore	Executive Managing Director, Commodities	20 February 2007
7	Livio Bencich	Director, Commodity Products	20 February 2007
8	Anne Fiddes	Director, Valuation Product Control	20 February 2007
9	Kirk Bertschy	Director, Risk Infrastructure	20 February 2007
10	Irina Stevens	Director, Counterparty Risk Models	20 February 2007
11	Alexander Tchernitser	Director, Risk Methodologies	20 February 2007
12	Sebastien Boyer	Senior Analyst, Market Risk	21 February 2007
13	Mickey Tanasijevic	Senior Analyst, Enterprise Risk & Portfolio Management	22 February 2007
14	Jeff Wang	Director Market Risk (NYC)	26 February 2007
15	David Lee	Managing Director – NG Option Portfolio	26 February 2007
16	Susan Jones	Director – NG Basis Portfolio	28 February 2007
17	Adam Lewis	Vice President, Trading	28 February 2007
18	Chris Coyne	Financial Analyst	1 March 2007
19	Ana May	Valuation Product Control	6 March 2007
20	Colney Seow	Head of Derivatives Observations	7 March 2007
21	Anton Rajinthrakumar	Manager, Commodity Derivatives Ops IBGPO	7 March 2007
22	Kevin Cassidy	Chief Executive Officer, Optionable, Inc.	3 March 2007
23	Tom Charlesworth	Director, Totem Commodities	1 March 2007

## APPENDIX 2: DOCUMENTATION SOURCES

Deloitte & Touche requested and received various forms of documentation from BMO Capital Markets personnel to gain an understanding of each department's business procedures and risk control infrastructure. Documents received by Deloitte & Touche were considered and evaluated to substantiate both our observations and recommendations, when applicable. Deloitte & Touche did not validate or test the accuracy of any documentation received. This appendix itemizes all the documents considered in this risk assessment for easy reference.

Item	Document Title
<b>Operating Policies and Procedures</b>	
1	Market Risk Corporate Policy
2	Traded Credit Risk Corporate Policy
3	Risk Management Committee Mandate
4	Replacement Risk Corporate Policy
5	Commodity Financing Paper
6	New Product Approval Process and Immediate Approval Process
7	CPG "Off-Premises" Trading Guidelines and Off Premise Procedures Feb 2007
8	Binder: Internal Control Governance Framework
9	Binder: Operations Procedure Manual
<b>Authority and Limit Letters</b>	
10	Authority Letter – David Lee
11	Authority Letter – Susan Jones
12	Authority Letter – Davidson Heath
13	Authority Letter – Adam Lewis
14	Authority Letter – Kevin Bodkin
15	Authority Letter – Robert Moore
<b>Reports</b>	
16	MVE and Stress Test Exposures (multiple)
17	Condensed Reports
18	Position-Season (Jan07) – NG – 1vol
19	CDG Risk Summaries (multiple)
20	P&L Analysis
21	P&L Attribution Data
22	CPG Management Reporting Package
<b>Charts</b>	
23	CDG Organizational Chart
24	Commodity Products Organizational Chart
<b>Other Documents</b>	
25	Job Descriptions
26	RMC Meeting Minutes
27	Model Vetting for PRA
28	Model Vetting for MxCom
29	Commodity Recalibration
30	NVaR Recalibration

Item	Document Title
31	Pipeline Calibration
32	Markit Valuations (Totem) – Processes, Procedures, Fees
33	Mid-Bid Reserve
34	Skew Calibrations and Impact of Skew Spreadsheets
35	Commodities Business Plan
36	Valuation Reserves and Adjustments Documentation
37	Transaction Table Extract (MxCom) (multiple dates)
<b>Pricing / Volatility Data</b>	
38	Month-End Independent Broker Quotes (multiple) – January 2007, February 2007
39	Pricing Grids from OPEX – January 2007, February 2007
40	Pricing Grids from Totem – January 2007, February 2007
41	Pricing Grids from ICE – January 2007, February 2007
42	Totem Volatilities – January 2007
43	Official Rate Source Document and Price Verification Policy
44	CDG Closeout and Liquidity Reserves Calculation Methodology
45	Independent Price / Rate Verification and Review

**APPENDIX 3: DETAILED LIST OF RECOMMENDATIONS**

The following is a list of suggested recommendation prioritized by the general categories of High, Medium and Low.

**HIGH**

Item	Description
1	Update IPV and ORSD stipulating Market Risk's independence with respect to the collection for market data.
2	Use multiple data sources beyond one primary broker source for price verification and validation.
3	Update Operating Standards and Procedures to specify the selection of independent market data sources and the hierarchical approach to using this data and method used to aggregate the sources.
4	Complete proposed changes to VaR methodology to capture seasonality and granularity in bucketing.
5	Formalize skew calibration process.
6	Standardize crude oil deal capture.
7	Allow for use of a 1 volatility threshold where differences are in excess of the zero threshold for options.
8	Consider utilizing an absolute dollar cap allowed under the 1 volatility tolerance.
9	Review current close-out charges to reflect market observed mid/bid spread.
10	Use unlagged delta and vega positions in the close-out reserve calculation.

**MEDIUM**

Item	Description
1	Update Risk Management procedures to clarify all newly adopted risk management methodologies and supporting business processes.
2	Update operational control documentation (i.e., limit letters) to expand on off premise trading, automation of price aggregation and certain risk management reports.
3	Update Market Risk Operating Standard documentation to include references to systems containing data related to market risk processes.
4	Update Market Risk Management Standard document to clearly define market risk tolerance.
5	Update Market Risk Corporate Policy and Market Risk Management Standard regarding the types of risk taken by the commodities desk.
6	Address and clarify roles and responsibilities for formal exchange and communication between Market Risk and Front Office personnel.
7	Delineate marketing and proprietary trading activities in existing natural gas options book.
8	Clarify and integrate standards standard and ad hoc risk reports according to role and purpose.
9	Implement risk weightings by customer segment and related transacting activity to ensure alignment of market risk exposure of the portfolio with the risk profile of the commodity business.

Item	Description
	exposure of the portfolio with the risk profile of the commodity business.
10	Implement real time counterparty credit checks to support commodity transacting (TCRMS).
11	Implement detail VaR limits by commodity, geography and tenor.
12	Consider lengthening VaR testing approach if BMO does not feel six selected days allows for enough testing..
13	Implement stress testing to the skewness of the volatility curves.

**LOW**

Item	Description
1	Develop a single credit reference document summarizing commodity credit practices.
2	Expand Credit Risk management processes by which transacting personnel are required to review and provide written acknowledgement of changes to credit risk management guidance.
3	Strengthen the language contained in the Ethical Standards and Compliance Guidelines related to compliance with credit practices.
4	Ensure daily trade desk meetings occur.
5	Research potential benefits of stochastic volatility surface modeling.
6	Document all approved methodology and procedure for modification to data feed from MxCom to the NVaR system.